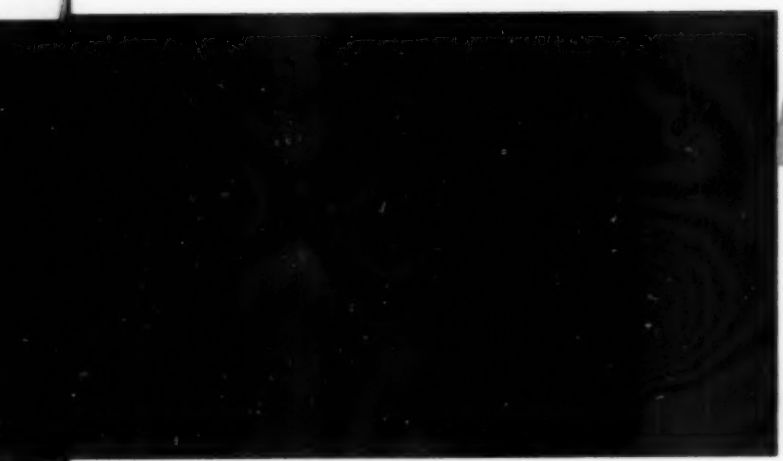
VOLUME TWENTY-FIVE NINETEEN SIXTY-ONE

AMERICAN JOURNAL OF PHARMACEUTICAL EDUCATION



25 ANNIVERSARY YEAR

THE OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF
COLLEGES OF PHARMACY

FALL

AMERICAN JOURNAL of PHARMACEUTICAL EDUCATION

AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY 1961-1962

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Published quarterly in February, May, August, and November by the American Association of Colleges of Pharmacy, partially supported by the American Foundation for Pharmaceutical Education, and printed by Plain Talk Publishers, Des Moines, Iowa. Subscription price $5.00. Single copies $1.25. Second class postage paid at Des Moines, Iowa. Postmaster: Undelivered copies should be returned to American Journal of Pharmaceutical Education, College of Pharmacy, Drake University, Des Moines 11, Iowa.

Editorial office: College of Pharmacy, Drake University, Des Moines 11, Iowa. Address all communications concerning manuscripts to the editor. Instructions to authors will be found in the announcement section of each Winter issue. Business office: 1507 M Street, N.W., Washington 5, D.C. Address all subscriptions and other business communications to the business manager. All new subscriptions begin with the Winter (February) issue. The Journal assumes no responsibility for statements made by authors.

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THE NATIONAL PURPOSE OF PHARMACY

The following five articles were written at the invitation of the editor as a series to help and to guide American pharmacists in the rediscovery of a national purpose.

The essays are part of the features planned to commemorate the Twenty-fifth Anniversary of this journal, concluded with this issue.

H. C. McALLISTER*

PHARMACY'S NATIONAL PURPOSE

Inherent in the matter of the national purpose of pharmacy, and as a precedent to any statement relating to it, is the question "Why is pharmacy?" On occasion I have asked some of my friends, "Why are you a Baptist, Methodist, Roman Catholic, or Jew?" as the case might be. Some have expressed firm convictions of belief as professed by their particular faith. But others (and this is the majority) really did not know and simply explained, "I was born to it, I guess." In pursuing the question further with the latter group I asked, "Well, why do you retain your affiliation?" and I got various answers—"I want to have my children come up under proper influences"; "I meet many nice people"; "I'm just supposed to"; or even, "I make my best contacts there." With such answers as these one might well ask, "Hasn't religion missed the boat?" That there is a need in the lives of all of us for some type of religion is a truism. But whether a given religion is fulfilling that need in the lives of everyone is an entirely different matter. I believe this same idea exists as it relates to pharmacy's situation. Today there seems to be a glaring lack of the "religion" of pharmacy with all too many of us, and this in turn has tended to destroy not only our effectiveness but our usefulness as well.

In our modern scientific world many people are asking whether or not there is a place for religion any more. This has been the traditional position of the Communist line. Such questions as these, of course, stem from the old-fashioned pseudoscientific approach of the condemnation of anything that cannot be proved in a test tube. It fails to take into account the substantial solid approach to religion made by such theological statesmen as Tillich and Silverman. The position of pharmacy today is not unlike that in which religion finds itself, and I think we must be honest and fearless enough to ask the question about pharmacy, "Is there, indeed, a need for pharmacy today?" I stated earlier that I believe there is a need for a religion in the lives of all of us. I am sure that those of us in pharmacy also feel that there is a need for our services in any adequate health care program. But this is a subjective appraisal. I

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think, then, that the first question to be resolved is whether or not there exists today in our modern society a need for that profession/vocation which we have known as pharmacy. Obviously this cannot be done by experiment, but there are other ways by which the question can be resolved and we must subject ourselves to this test. I am not willing to run the risk of perpetuating what could be a grand delusion by our failure to do this. All doubt with regard to our usefulness must be removed. Some may ask if I am not suggesting a risky game. Of course, it is risky; but at the same time it is not a bluff. I feel that we will be leading from strength.

It is a well-worn technique of the T. V. playwright to have a scene open with the hero being hit on the head by a sinister character and then have this hero shortly "come to" and exclaim, "What happened!" I wonder if pharmacy's position today is not about like that of this hero, except that, instead of a single blow, pharmacy has been given a thorough going over in recent years by a good many characters whose motives were less than that of contributing to the professional status of pharmacy.

I think many of us who are wont to consider ourselves as being among the leading characters in the drama of health care are now beginning to recover sufficiently from our mental confusion after the series of recent assaults made on us to say, not only "What happened?" but also "Who and where am I?" Perhaps there is still enough of our memory left that when we are recovered from the blows we can again orient ourselves into our proper place. If not, let us hope that there are enough of our friends around who were at the scene of the fracas and who know whom we are to help in our search for identity and recovery. Let us also hope that this play is not one of those tragedies in which the main characters "get killed off." The tragedy of this affair is that it is not play-acting at all but grim reality.

I have been invited, as president of the National Association of Boards of Pharmacy, to contribute an article for this special feature section of the *Journal*. It is understood that this series will be devoted "to analyzing and to determining the national purpose of pharmacy."

In seeking to make a determination of the essential usefulness of pharmacy, the questions naturally arise, "What is pharmacy?" and "How well are we prepared to answer this question?" During one of the recesses between sessions at the A.Ph.A. convention in Chicago it was my pleasure to find myself in the company of a number of pharmaceutical educators, members of pharmacy boards, and, I believe, a hospital pharmacist. After several rounds of the inhibition-lifting refreshments had been served, I asked my friends the questions, "You say you are a pharmacist. Well, just who are you and what do you do?" Someone started to reply, "Pharmacy is that branch of the health sciences that has to do with . . ." and he stumbled through a number of things such as collection, preparation, and the rest of those things which he could recall from memory. Pursuing the question f u r t h e r with "Well, just what do you do?" brought the reply, "I fill prescriptions, and I stock and sell drugs." This banter continued with everyone talking at once—"We need this," or "We ought to do that"—and the answers to my question, if there were any answers, were lost in the confusion. I don't know that reference to this "bull session" has any particular value here except for one thing. It is my opinion that if the question of "Who are you and what do you do?" were seriously put to almost any pharmacist, he could not give an answer that would be far different from those I received from my friends. This being

true, what can we reasonably expect from the public and from the allied health professions when they have an occasion to appraise us?

Assuming that we successfully meet the test of essential usefulness (and I think we will—and if we don't, we will have saved future generations of pharmacists from a fate that will be even harder to endure), what should (not what will, lest we get back in the same old rut) our nature be? In the past we have heard much about the "rightful place" and "professional stature" of pharmacy. I will refrain from expressing an opinion as to whether or not these phrases have merit at the present time, since I do not want to be accused of begging the question. As I see it, it makes little difference what we have to say about the matter—trade or profession. Pharmacy will be classified for what it is. In recent times many vocations have assumed for themselves the title of "profession" in the hope of enjoying the special considerations that accrue with this designation. However, aspiration and self-pronouncement are not enough to accomplish the fact.

From a philosophical consideration of vocational activity, we learn that three main forces determine the dimensions of service rendered by a given vocation and that the public appraisal (public image) and social status of that vocation are established in the end by the importance of that vocation to the life and happiness of the community, and by how well that vocation understands and fulfills its obligation to the community it serves. In the main, these three forces are competition, government, and profession. The course of any given vocation is determined by one or more of these forces, exercising its influence in varying degrees depending on the vocation affected, and each has its own means of enforcing its requirements or making its effects felt. I should like to discuss briefly these several forces as I believe they relate to pharmacy.

In some areas of vocational activity, competition is about the only influence regulating the scope of that activity. Generally, as the requirements for entering a vocation become more rigid, the elements controlling it gradually shift from competition, through government, to profession. For example, a common laborer has little to regulate his vocational activities other than his ability to get a job, but a neurosurgeon is limited in his field almost solely by his professional competence. In the public mind, competition has been most consciously associated with the merchant. In recent years, the activities of the pharmacists have been such as to come to be associated with those of the merchant, and, in all too many cases, the pharmacist has not only accepted this attitude but has himself embraced it. When the pharmacist's activities are such that they are affected largely by competition only, the jungle tactics that are so often associated with this force begin to operate, and the public becomes confused as to the pharmacist's status. Because of this confusion, which he too often shares with the public, the pharmacist is forced into a position of frustration. I believe this to be the state of affairs in which we find ourselves today. I do not contend that competition should have no place in regulating vocational activity, including the practice of pharmacy, but I do think it is this force that has been the source of our trouble. Traditionally, pharmacy has felt that it must subsidize itself with commodity commerce. I have been among those who have supported this view. However, the extent to which commodity commerce has been carried on in the places where pharmacy is supposed to be practiced and the methods used to promote this commerce have caused me to question the propriety of this posi-

tion. Perhaps tradition has led us to accept this tenet. We need to re-examine this whole question of the subsidy of pharmacy practice. Having resolved this question, we must reorient ourselves in a course of activity that is compatible with our basic purposes and objectives.

The records from the time of man's earliest civilizations show how, in each period, he has found it necessary to regulate his society through laws which were made to protect the group from certain actions of its individual members. Although there are glaring exceptions, most of these laws were designed so as to accrue to the protection and welfare of the citizens and, in general, to the common good. Almost invariably they were designed to control conduct which was contrary to what we call the Golden Rule (as applied not only to simple human relationships, but also to those more refined and complicated systems of behavior and conduct). In general, they served to provide direction in the absence of a "creed" or other prescribed course of conduct, or to punish violations of established mores and customs. Our laws today do little more than this. And laws, like the rains, fall on the just and the unjust alike. One cannot have a justifiable objection to a situation such as this except that, perhaps, while a certain act in one set of circumstances may be harmful to another, under a different set of circumstances it may be an act of extreme benefit. Laws are not yet so refined and perfect that they can always adequately distinguish between these widely separated positions.

It has been stated that there are few vocations that are more completely surrounded by legal regulation than is pharmacy. If this is true, why is it so? Is the nature of pharmacy such that it cannot be regulated except through legal control? Could the services of pharmacists be made more useful through some other method of control—say, profession? Or is the composite moral fiber of those engaged in pharmacy such that they cannot be entrusted with self-regulation, which is one of the prerequisites of profession? It is a fact that the practice of pharmacy today is surrounded by a continuously increasing legal bound. It is also a fact that this legal restriction has materially reduced the usefulness of pharmacy, both to the health professions and to the public. It is of utmost importance that we make an objective determination of the extent to which pharmacy must be controlled by legal measures and transfer any additional controls to more appropriate areas, if this can be done.

We come now to profession. Perhaps one of the most difficult things that we as members of society encounter is the task of adequately and accurately communicating ideas. Misunderstandings between individuals, organizations, and nations arise because of this difficulty. The human mind is capable of such a vast area of activity, which is in turn modified by emotional influences, that it is little wonder that means of transferring ideas from one individual to another, or to a group of individuals, often leave much to be desired. This deficiency causes many false notions to become established.

One idea that has come in for much abuse is that of "profession." We hear about the professional boxer, the professional baseball player (and the Supreme Court has said that baseball is a profession), the professional this and the professional that. Then we hear about "the professions," and here one hesitates to name names. What is the difference? There is not much debate about the classic designations of law, medicine, and the ministry as professions. But when one tries to classify some of the newer vocations, for example, business administration, he may

get into trouble. It would depend on whether an attempt was being made to include or exclude business administration as a profession.

I said earlier that one hears about the "ancient and honorable profession of pharmacy." Not infrequently one detects a note of uncertainty in the speaker's voice when he proclaims pharmacy "the profession." In recent years events have occurred that have caused other people to talk about pharmacy in such terms that one knows there is no uncertainty in their minds on the point that pharmacy is not a profession. This matter is, of course, important to us. To make a determination of whether or not pharmacy is a profession, we must have agreement on what is profession as well as what is pharmacy. Let us look first at profession. For our purposes here, one of the best treatments of this subject that I have seen is contained in the *Annals of the American Academy of Political and Social Science*, **297**, 1955 (Jan.). Here a number of authors comment on professionalism as a means of vocational control. The opinion of what constitutes profession seems to be rather uniformly held by each. They feel that there are three basic requirements to be met in order for a vocation to qualify as a profession:

1. that practitioners acquire an intellectually based technique;
2. that practitioners assume a relationship of responsibility toward clients;
3. that practitioners are organized into responsible associations which set standards for admission to practice and exert control over the actions of their members through codes of ethics. (Charles L. Braucher, in his paper "The Social Image of Pharmacy," has stated these ideas in somewhat different terms.)

Here, there seems to be fairly uniform agreement on what constitutes profession. To determine whether pharmacy qualifies (or should qualify) for this designation, let us ask again, "What is pharmacy?" I related earlier how this question was posed to a group of individuals who represented a cross section of pharmacy. The fact that I did not get a satisfactory answer is not surprising. At this moment I do not believe that I could anwer my own question to the satisfaction of everyone. This is because there is not full agreement on the scope of the proper activities of pharmacy. Until such time as there is greater unanimity of opinion on this all-important matter, we are stopped dead in our tracks in the quest for a solution to our problems. Failure to agree in this area can lead only to compounded frustration. Before we can find out "who we are and where we are going," someone must define, for all to know, the duties and responsibilities of the pharmacist. I think that those who say pharmacy has a rich heritage are right. But this heritage was built on a system of activities centering around the individual pharmacist. Considerable changes have taken place during the years, and included in these changes have been alterations in and additions to the functions performed by the pharmacist. I wonder whether some of us who are engaged in pharmacy might not have failed to change pace with the times, and whether some of the opportunities for profession have not been lost by default.

In reminding me of my promise to write this article, Dr. Granberg stated, "I hope that from these papers the profession will receive a call to develop a 'fire of commitment' in the rediscovery of a national purpose . . . I hope that from these papers pharmacy will be able to hammer out a new Magna Charta to chart its course for the next few decades." To my mind these two sentences say more than everything I have written. It seems to me that the solution to our problems might be

simple. It is the implementation of this solution that gives me great and immediate concern. As stated above, someone must define the duties and responsibilities of the pharmacist for all to know. What is the scope of his proper service to society? We have attempted to answer this question in the past through "surveys," "reports," and the like. All of these have been useful. But have we ever put the question squarely? Haven't our previous inquiries been too subjective? Have the allied health professions and the public which we serve had the opportunity to express themselves adequately on this matter? Unless this opportunity is provided and we receive the assurances of an existence based on essential service, is there not a possibility that we may find ourselves cultivating a sterile soil in which there is little chance for growth or even for survival? This is an "offer of proof" I feel we must make. Conversely, if our scope and objectives are well defined and properly based, we already have all of the other necessary elements for solution—fine schools, strong associations, and, above all, people who are seeking "salvation." When the time arrives that we will have found out "who we are" and "where we want to go," the guide lines thus provided will point the directions on this road that presently seems to lead to nowhere.

Our present situation may very well turn out to be a Dunkirk for the professional aspirations of pharmacy. Indifference to professional obligations is not our only adversary. Even though we may regroup our forces to withstand the present onslaughts on professionalism, we must still prepare ourselves to do battle with the tyranny of the socialistic influences that are attempting to control the lives of people everywhere. Even though we may solve our immediate problems of identity and scope of duty, as I think we will, we will accomplish little if we fail to do those things that are necessary to maintain a climate in which political freedom and liberty exist as they relate to health services, and in which the benefits of individual enterprise can mature to full fruition. Since this is a problem which we share with all of the other health professions, we must establish better lines of communication with other areas of health care through which a unity of total purpose can be developed. This is a duty of us all.

WILLIAM S. APPLE*

PHARMACY'S NEGLECTED CHALLENGE

A young practicing pharmacist wrote to me recently to say that he was leaving the profession. While the news was disheartening, it was not totally unexpected.

I had first heard from the young man, a 1958 graduate, about a year after he had received his license to practice. He had expressed doubts then about his profession, particularly about the personal conflict he had had trying to reconcile the commercialism of daily practice with his highly scientific and professional education.

Now, after two more years of service in an urban pharmacy, he has resolved to settle the conflict by leaving the profession. I know that this is not a hasty step for him. The young man is mature and logical, and he has given much thought to the matter, including his family responsibilities. He recognizes that he must provide a comparable new income for his wife and children. Not everyone would be able to do this; unless a man is equipped for another career there is bound to be a long financial readjustment while he re-educates and re-establishes himself.

This young man's decision and his dissatisfactions symbolize one of the most important and neglected challenges for the profession of pharmacy today. It is this: How can we expand the opportunity and improve the character of our professional practice so that in the future pharmacists can find more personal satisfaction?

Some will say that today's pharmacists have satisfactions undreamed of twenty-five years ago. That's true, but almost all of these satisfactions are materialistic things—higher pay, shorter hours, fringe benefits, and so on. As marvelous as these things are, there are still the basic, personal satisfactions a professional man also needs and wants —use and perfection of his specialized skills, professional recognition, and a chance to contribute to the welfare of his fellow man.

As Thomas Wolfe said, "If a man has a talent and cannot use it, he has failed. If he has a talent and uses only half of it, he has partly failed. If he has a talent and learns somehow to use the whole of it, he has gloriously succeeded, and won a satisfaction and a triumph few men ever know."

Perhaps a look at conditions facing young pharmacists today will help us. A young man or woman entering the profession now has a background of five or six years of highly specialized, scientific and professional training and has completed an internship before being admitted to practice. He has been imbued by his teachers with a professional esprit de corps and a zeal for ethical conduct. He is eager to serve his fellow citizens

*Secretary, American Pharmaceutical Association

and his professional associates in the medical team.

But what does he find? He sees his profession being tried and convicted by newspaper headlines. He reads and hears powerful government leaders accuse his professional colleagues of profiteering and of preying on the unsuspecting public. He sees irresponsible merchandising schemes springing up across the land promoted as equal substitutes for personal, professional service. He sees a U.S. judge declaring professionalism irrelevant in antitrust proceedings, opining that pharmacists are only merchants.

He is exposed to propaganda and sees efforts being made to unionize his profession. These organizers recognize pharmacists' dissatisfactions and are attempting to capitalize on them. Sign up with us, they say, and we'll get you recognition. We promise you, they say, that you will be treated as full-time professionals and have a voice in your profession if you let us help you.

Let me say, by the way, that the fact that these organizing activities aren't visible everywhere doesn't mean that they are not going on. They may be operative just below the surface and may be meeting with more welcome reception than we suspect. If we ever do see them erupt across the land, it will not only mean that they have been successful, but more importantly, that the profession will have lost the opportunity for corrective action.

Twenty-five years ago the young pharmacist had fewer forces bedeviling him. It was a time of economic chaos, of course, but it was also still the age of free enterprise and the entrepeneur. Young pharmacists then aspired to be their own bosses; their bench mark was ownership of the corner drug store, and most of them eventually achieved it. The manipulative skills which predominated their early professional activity have been transferred to the pharmaceutical industry. With those skills went the public recognition formerly accorded to the pharmacist for them.

Despite the profession's satisfaction with its new role as an expert consultant and custodian of potent chemotherapeutic agents, there is today less recognition for the professional contributions of the pharmacist by the public and by medical practitioners.

Perhaps the notable exception is the status young pharmacists in rural communities enjoy. Their colleagues in the health team welcome and appreciate the important new contributions which these pharmacists make. Where there is no interprofessional competition, rural pharmacies are relatively free from economic pressures, unless they are in a distress area. The young pharmacist is encouraged by his employer to utilize his new scientific knowledge. Recognition as a professional brings personal satisfaction.

But the majority of young pharmacists must look to the urban and large metropolitan communities for employment. Do they find the opportunity for personal satisfaction there? It has been recognized that hospital and apothecary practitioners generally do. Others, for whom the professional aspects are overriding, gravitate to clinic pharmacies or to those super retail stores with prescription departments where they find employment as full-time professionals. It matters not so much to these young people who owns the store as long as they can be full-time pharmacists.

Though the latter roles may be professionally satisfying, such employment may provide plenty of discomfiture. For one thing, the man in the physician-owned pharmacy is usually considered a deserter and treated as an outcast in pharmaceutical circles. Likewise, the Barnum & Bailey atmosphere of the

super retail store is a continual psychological irritant to the professional employee. He may be isolated in his prescription booth in the rear of the arena, but every time he peeks out what does he see? He sees Bagdad with push carts.

Another small group sees no conflict at all. They are business inclined and financial adventurers. They want to own and manage a business of their own and they have the acumen to do it. To them pharmacy is a business and any professional connotation in which it can be cloaked is a merchandising plus.

Let me take a minute here to explode a myth that is considered almost gospel in pharmacy. It is NOT, repeat NOT, the ambition of every young pharmacy graduate today to own a store of his own. This may have been true twenty-five years ago when the corner drug store virtually was all we had. It is not true now. The ownership road with a financial future has become hazardous and limited. Capitalization requirements are almost prohibitive for the individual pharmacist. The hours are long and arduous, profitable business methods and efficiencies hard to learn, tax laws and government regulations become more complex daily. Add to all of this the fact that there may not be enough professional opportunity to satisfy the young pharmacist and he ends up feeling like a boy merchant competing with the sales wizard across the street. The successful retailer, after all, creates demand. The successful professional in medical care works to eliminate it.

This brings to mind another misconception that needs clarification. It is often said that pharmacy is both a profession and a business. Far too much emphasis is put on the word "business." The practice of pharmacy for which individuals are trained and licensed is not a business per se. The pharmacist has a responsibility to use wise, efficient business methods in operating his professional practice. The physician, dentist, or attorney use correct management practices to keep track of their appointments, supplies, and expenses but no one calls them businessmen because they do this. They put such business activity in proper perspective. As a result, their professional image is not distorted to the public.

We in pharmacy, therefore, may be doing a disservice to our young people when in our recruiting we say that they can be both a professional and a merchant. The sad contrast is that the real retailers of the country have been busy earning bachelor and master degrees in commerce and business administration while our young people have been studying the sciences.

To get back to the opportunities for the young pharmacist. The majority of them, not choosing or being able to choose specialized situations, make the most convenient choice there is—general practice in an urban or metropolitan community pharmacy.

If conditions are right, our young man and woman may find the professional fulfillment and satisfaction they need. They may, for instance, spend their time dispensing and compounding and serving the public by guiding their purchases of drugs and health care articles which have not been prescribed. They may, as a scheduled procedure, serve as therapeutic consultants to their prescribing medical associates. They may, also as a scheduled procedure, disseminate public health information. They may, with the encouragement of their employers, help generate a professional atmosphere which would cause the public to think of the pharmacy as a community health center.

But is this all possible? Unfortunately, not often enough. Social changes and economic forces are at work. Shopping

centers and public mobility are changing neighborhood patterns and living habits; rising operating costs and legal complexities are squeezing and exasperating independent pharmacy owners. More alarming, distribution czars are eyeing the pharmaceutical field seriously and eagerly watching for the opportunity to convert professional functions to distributive techniques. Mail-order and commercial promotion of prescription drugs directly to the public are already being utilized without regard to public safety and welfare.

What then, are we going to do? Are most pharmacists to be forced to operate almost wholly in a nonprofessional environment? Are they to be trapped there? I see little chance that these trends will be reversed without a struggle.

Today some pharmacists are full-time professionals in an acceptable professional environment. Others are full-time professionals in an environment neither wholly acceptable to them or to the profession. The remainder become part-time professionals in an assortment of environments varying in professional acceptance. The result is that the majority have not found personal satisfaction.

The young man who wrote to me was a member of this majority before becoming a casualty. In the future, young men and women entering pharmacy must have the opportunity to become full-time professsionals in environments which offer the personal satisfaction of serving mankind and self. This is the neglected challenge facing the profession.

JOHN W. DARGAVEL*

PHARMACY AND THE ONRUSH OF CHANGE

Today change occurs much faster than ever recorded before in the history of mankind. It is easy to feel baffled as we see traditions crumble and landmarks obliterated.

Many people think of change as progress. Yet it may be just the reverse since change moves backwards as well as forewards. Also individual and collective attitudes fluctuate and, quite often, they shift from reason to notions based on delusions or misguided emotions.

Pharmacy as a profession is affected by trends, be they good or evil. Economics cannot be escaped or avoided. Politics embraces everyone of the population and the clamor of an organized and aggressive minority now and then brings about the enactment of detrimental legislation. Moreover, upsurges of agitated opinions create nationwide confusion, and, for a time, considerable uncertainty overspreads the country.

The point I wish to make is that pharmacy, like every other profession, is entangled in the existent conditions. It cannot evade the events of change or the consequences of implemented hallucinations or clashes of virile ideas or turmoil compounded in the mortars of global conflicts. Only on an island uplifted in dreams is there to be found peace and tranquillity and order. Pharmacy is human and therefore never will be confined to a stationary structure isolated from the dynamics of change.

Pharmacy at present seems to be overloaded with problems, and we often hear pessimists insist that the profession is headed toward a menial status (most of them think from the viewpoint of a bygone period, or they lack the intestinal fortitude needed to challenge the realities of a complex industrial society). I hold fast to the belief that pharmacy as a profession will climb with progress. The services of pharmacy contribute too much to the general welfare to be minimized, and, moreover, they are sure to increase instead of diminish in value as the conquest of diseases continues.

Today the serious problems of pharmacy are for the most part in the retail field, and many of them stem from the revolution in the commercial distribution of commodities.

I have on numerous occasions discussed the revolution in the commercial distribution of commodities as follows:

The revolution in commercial distribution follows a pattern that long in the past evolved in the concessions of the carnivals and the midways. The main rule of the pattern is to play the public for suckers. P. T. Barnum used it to attain fame as a showman. You have read stories about the tricks he pulled to deceive the public, and the people fell for them to an extent that today seems fan-

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*Dr. Dargavel was Executive Secretary of the National Association of Retail Druggists. He died suddenly while this issue was in press, on October 11, 1961.

tastic and ridiculous. Perhaps you think of the people in the eighties and nineties as dumb . . . gullible . . . easy to fool. Now the public is said to be much more intelligent . . . of the mind to laugh at absurd claims made for products and services . . . alert to the tricks of the predatory merchants.

It may be true that the consumers of today are smarter than the people of bygone generations. Yet there is an abundance of evidence to the contrary. The evidence includes:

1. The growth of the discount houses;
2. The success of such gimmicks as special prizes . . . rebate coupons and stamps . . . two for the cost of one plus one cent . . . supposed bargains on unknown brands . . . giveaways of various other types;
3. The results derived from ballyhoo and the promotion techniques copied from the spielers of the medicine shows and the carnivals and the midways.

Manufacturers of a large number and variety of products have adopted policies in harmony with the tricks . . . the fakery . . . the ballyhoo . . . the razzle-dazzle of deception and cutthroat competition in the retail field. The policies have enabled the discount houses to flourish . . . the predatory merchants to prosper . . . the cutrate dealers to profit from deception of the consumers . . . and the consequence is that the legitimate, the reliable, the honest retailers find it a serious problem to survive. It seems that the numerous involved manufacturers have decided in favor of the promotion techniques of the medicine shows and the carnivals and the midways, unscrupulous though they be and however much in conflict with decency in business.

Also the independent retail druggists worry about the future as they ponder the potentials of:

1. Pharmacy facilities operated by physicians or hospitals;
2. Cutrate mail order suppliers of medication;
3. Drug stores operated by labor unions; and
4. Dispensers of medication at discount prices to an unrestricted membership.

How extensive will they grow to be in the next decade? It is hard to tell.

Another factor to consider is the common belief that prescription medicaments cost too much. Certain medicaments seem to cost too much. One of the reasons is that most people find it hard to think in terms of the miracle lodged in a dozen tablets of an effective preparation. They see the tablets in much the same manner that they do dried navy beans, and hence they often denounce the owners of drug stores as robbers.

Another reason for the negative attitudes of the public toward the cost of medicaments is that people resent every expense forced on them by misfortune. It is ironic that the benefits derived from a medicine prescribed for an illness count second to the amount it cost in the mind of most persons. One recent poll showed that more than 65 per cent of the people included in the study favored federal control of the prices charged for every medicinal. They failed to see the serious consequences of the position they took in the poll.

It is evident that the majority of the people has been misled through the juggled figures of political jingoism centered in Washington, D.C. The common belief is that greed is supreme in the areas of pharmaceutical production and distribution.

Misguided politicians and numerous other deluded persons seek to bring about legislative restrictions that would hamstring medical progress in America.

They have resorted to fantastic arguments in support of unwise federal statutes aimed to bring about further control of pharmaceutical production and distribution.

It is urgent to prevent the enactment of legislation that could obstruct the search for additional potent medicaments. Hence pharmacy must take an active part in the efforts being directed to block government regimentation of the pharmaceutical manufacturers.

Up to 1935 America trailed behind Europe in the development of medication. Now it is in the forefront. How long will it be there?

It is agreed that legislative restrictions are necessary to protect the health of the public. However, to make them the means to destroy capitalistic enterprise in pharmaceutical production and distribution would be colossal stupidity.

Freedom from monopoly and government regimentation made possible the great strides that have been made in the development of medication in the United States. Now the outlook is that government domination over business and industry might before long cripple and, in time, destroy capitalistic enterprise in the sphere of health. It is a hazardous situation.

History seems to tell us that conflict of opinions and unrest and turmoil forerun progress. Contentment nourishes stagnation. Enforced compliance with ignorant and arbitrary conformity confines a society to the marshlands. Clashes of antagonistic theories and concepts cannot be evaded. Individual and group interests will never be one and the same. Greed skulks in the marketplace and elsewhere despite the admonitions of the clergy and the laymen moralists. Failures or refusals to think in terms of the general welfare will ever call for corrective measures.

Pharmacy must be alert to the realities. They may distress us and yet there they are. Only to bemoan the trouble many of them cause pharmacy achieves nothing. One must, in order to bring about needed solutions, strive as an individual and in united action which follows a course based on intelligent conclusions. It is folly to slumber with complacency or to walk alone remote from the legitimate organized activities of pharmacy.

It is a difficult task to persuade more than a meager fraction of the independent retail druggists to devote time to the objectives proved to be important to them and the profession of pharmacy in general.

Efforts to arouse support for an aggressive campaign in behalf of a project or legislative proposals too often encounter deplorable lethargy though coupled to a mandate. The record reminds us that the independent retail druggists in the past fought with magnificent determination and mobilized strength and that they won many victories. However, in recent years the prevalent attitudes have tended to be negative to the nationwide programs of pharmacy despite the trends now liquid and in motion against the independent retail druggists of the country.

It disturbs me that too many of the pharmacists refuse to participate in the programs of organized pharmacy. They never "bother" to write even a postcard message in support of a particular piece of legislation however important it is to the profession of pharmacy or the independent retail druggists. It is too much trouble for a large number of them to join in the activities of the local pharmaceutical association, and it is rare that they attend a state or national pharmaceutical convention. They never make as much as a gesture of assistance in a campaign directed in the interest of pharmacy as a profession or of the independent retail druggists.

Pharmacy must recover the spirit that

achieved notable victories in bygone years. I find it hard to account for the extensive complacency and indifference toward issues that ought to be of serious concern to every person identified with the profession of pharmacy. Various examples could be cited to spotlight a deplorable situation. I will touch on one.

Fair trade is vital to the survival of the independent retail druggists. Yet in the fight to bring about the enactment of the national fair trade bill only about two in ten of the individual drug store proprietors nationwide took part in the drive in behalf of the bill. Then on top of it, the loudest criticism for the outcome of the fight to restore the potency of fair trade came from among the independent retail druggists content to be at the most nothing more than sideline observers.

The encroachments of government have moved to the point where every business is subject to regulatory statutes and the dictates of bureaucracy. The trends run toward more authority centered in government instead of less. Hence politics ought to be of serious concern to the people in business.

It is a foregone conclusion that detrimental legislative proposals will always trouble pharmacy in the retail field. Vigilance is mandatory to prevent the passage of objectionable measures introduced in the legislatures and Congress.

One of the problems, and it is major in scope, is to induce the majority of the independent retail druggists to take an active interest in politics. The identical situation exists in every other sphere of business.

Pharmacy in the retail field must return to the arenas of politics and there fight with aggressive determination for the essentials of survival. Today, except for the oldsters with memories of the hardships they endured in the twenties and thirties, the independent retail druggists for the most part indicate that they hate politics and participation in the organized activities of pharmacy.

Here on the desk before me as I write is a report on a rally that flopped though it included a program devoted to the problems of survival in the retail drug field. "Only about a hundred of 1,300 members attended," the report says. "How does one explain such a deplorable turnout?"

I wish I knew the answer to the question of the quoted portion of the report. However, it is evident that apathy permeates pharmacy nationwide.

You have only to turn the pages of history to learn that in the score of years before the turn of the present century pharmacy floundered in the storms of change. Leaders among the individual owners of drug stores tried to steer clear of the reefs. They had to resist the erosion of dejection in the profession of pharmacy. "Undersellers" (as they were termed at the time) and "abettors" (manufacturers of proprietaries and wholesalers in the drug field) made it tough to survive as legitimate operators of drug stores, and most of the latter were "in the clutches of sullen apathy."

The upturn in pharmacy started with a nucleus of undaunted retail druggists. They refused to surrender to the pessimism that overspread pharmacy. The leaven of the spirit they possessed took hold in every section of the country. From then on up to recent years most legitimate pharmacy operators were united in aggressive programs directed to improve conditions in the retail sphere of pharmacy.

You may think that pharmacy in the past escaped "smears" such as have occurred in the last couple of years. Then you are wrong. The *N.A.R.D. Journal* as long ago as half a century told about newspaper articles that assailed "crooks" in drug stores. Here is one example:

A newspaper with the aid of a pharmaceutical chemist made an investigation of "jugglery" in prescriptions. It was revealed that "prescriptions for definite quantities of prescribed chemicals were compounded in a haphazard fashion" or "with the view to economize on the ingredients at the expense of the patient." "In one case," the newspaper reported, "tap water was sold for a solution of the expensive rubidium iodide."

The public must have been misled to believe that the "exposé" pointed up a common occurrence when in truth it was most rare. However, such is the curse of isolated incidents of misconduct in a profession heralded to the public.

Now in recent years pharmacy owners in general have been made to endure undeserved attacks. Probes intended to be of help in politics, instead of value to the public, have raised havoc in the form of extensive and unfounded protests against prices charged for prescribed medicinals. Unwarranted allegations broadcast nationwide have deceived the public in that they emanated from federal sources thought to be reliable, and hence pharmacy in the retail sphere suffers from widespread erroneous conclusions.

It is evident that the turmoil in pharmacy overflows with complexity. Is it transitory or must we prepare for a situation in which pharmacy as we know it today will undergo a drastic change? The answer cannot be more than a guess. Nevertheless there are certain possibilities that must be considered:

1. The unions may open drug stores in every sizable city of the country.
2. The giant food chains and supermarkets may invade pharmacy services on a scale that would destroy numerous thousands of independent retail druggists.
3. Chains of drug stores which belong to the category of predatory merchandisers may multiply.
4. Mail order firms in the drug field may grow instead of diminish.
5. Pharmacy facilities owned by clinics and physicians in group practice may become usual.
6. Outpatient departments of the hospitals may make it regular to provide pharmacy services in competition with the drug stores.

The enumerated possibilities added together total enough to make it appear that the future of the independent retail druggists is abysmal indeed and that the profession of pharmacy is headed for a status composed for the most part of employees with meager prestige and circumscribed opportunities.

Pessimism must be resisted, or it will destroy the spirit that is needed to cope with the onrush of change.

Nevertheless, it is unwise to minimize the effects of change that moves at a tempo much faster than ever before in human history. Moreover it is folly to think from the viewpoint of yesterday. Notions born of outmoded and obsolete concepts must be discarded.

Much has been said and published about the "image" of pharmacy in the retail field. The diminished prestige of the drug stores as such cannot be restored through ballyhoo miscalled "public relations." The truth is that public relations consists of elementary ingredients. Included are:

1. The interior and the exterior appearances of the pharmacy.
2. The manner in which the customers are treated.
3. The nature and the extent of the provided facilities.
4. Efforts to enlighten the public on the primary function of pharmacy in the community.
5. Activities planned with the thought

of counteracting erroneous conclusions based on publicity intended to advance ulterior purposes.

6. Participation in community projects.

I am in accord with a statement contained in an article on public relations addressed to the independent retail druggists. Here it is:

"First in effective public relations is YOU. You must like people. The attitudes you nourish must be in tune with the ideals of pharmacy. You must be responsive to the unselfish urges to be of help to people. So take time to study YOU."

Public relations continue to be haphazard in the retail drug field, and, to correct it, most of the individual pharmacy proprietors must revise many or some of the ideas they have on the elements which compose public relations.

It is rash, perhaps, to forecast in detail the things that will happen in the retail drug areas. Nevertheless it is said quite often that:

1. Most of the "papa and mama" drug stores are "on the way out."
2. The independent drug stores will average much larger than most of them are now; a sizable amount of floor space is needed for effective displays of merchandise.
3. The number of independent drug stores per capita will decrease despite the growth in population. (The capital needed to purchase a profitable pharmacy or to establish one will become too much for most of the younger employed pharmacists to raise. Also the extent of tough competition will tend to discourage investments in independent drug stores.)
4. The ratio of employed pharmacists to independent owners of drug stores will increase a sizable amount.
5. Most of the employed pharmacists will be unionized in order to bargain in strength on wages, hours, duties, fringe benefits, etc.

The reader may question one or more of the predictions. I mention them only to stimulate incisive thought.

It is unwise to maintain adamant attitudes toward the indications of the trends in the retail drug field and in the profession of pharmacy in general. Moreover, refusal to think in terms of change is a mistake, and it is usual that the error leads to serious blunders (and one of them is to be afraid of progress).

LLOYD M. PARKS*

WHAT PRICE PROFESSIONALISM?**

A survey of the contemporary pharmaceutical scene gives reason for concern and even at times dismay at the problems that pharmacy is facing. Mail order prescription activities, drug counterfeiting, generic name versus trade name drugs, welfare prescription plans, prescription price fixing charges—these are some of the most common problems we are hearing today. Perhaps the most serious one of all is the Kefauver investigation of the drug industry. Conducted in an atmosphere of trial by investigation and guilt by publicity, the immediate effects of the Kefauver hearings have been alarming and the more important long-range effects are yet to be determined. Many of the other current problems may be considered as the sort of development that might have been expected from those hearings.

When we contemplate the apparent turmoil in which pharmacy finds itself, we may feel that these problems are too big to be solved and may also develop misgivings about the future of our profession and our own career in it. In my judgment pharmacy is in no more precarious situation and its future holds no more foreboding than many other fields of activity. Its current problems are all a part of the ferment which pharmacy is undergoing in its adjustment to the demands and practices brought on by the modern atomic age and by the changing social, economic, and political environment in which we live.

The pharmaceutical industry as we know it today, which largely controls the destiny of pharmacy, is a product of the modern industrial and scientific revolution. Science and technology, and the commerce that results from them, have advanced more rapidly in pharmacy than have the social and behavioral sciences in coping with the effects and consequences of those advances. But is this situation any different from that in many other fields in which science and commerce are, by the very nature of the field, inseparable?

Despite their obvious political ramifications and their accompanying exaggerations, the Kefauver hearings have given us reason to stop and to take stock of ourselves and our profession. Certainly, in the past several months, our public has been doing just that. Unfortunately, too much of the public's evaluation, or revaluation, of pharmacy has been guided by the sensational news releases and editorials that have appeared in the daily press. But a number of well-considered analyses by writers of stature have also appeared in the lay periodical literature, and these have been something less than flattering. So it would appear most appropriate for us

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**Edward Kremers Memorial Lecture, delivered at the University of Wisconsin, April, 1961.

to look at ourselves with honesty and reality.

What is pharmacy? I am not thinking here of an academic definition, but of a functional description which includes all the activities that the term brings to mind. Is it a profession, a business, a trade, an industry? The joint committee of the American Association of Colleges of Pharmacy and National Association of Boards of Pharmacy, appointed to redefine the term "Pharmacy," offered, in its report last year, the following definition which seems to fit the requirements:

> The 'practice of pharmacy' is the practice of that profession concerned with the art and science of preparing from natural and synthetic sources drugs and medicines for use in the diagnosis, treatment and prevention of disease, including their proper and safe distribution, whether dispensed on the prescription of a medical practitioner or legally dispensed or sold directly to the ultimate consumer.

Let us look at that definition in more detail. You will note it states that pharmacy is a profession. It involves the preparation of drugs and medicines, which includes the concept of an industry, giving reason for use of the adjective pharmaceutical when we refer to the industry. Furthermore, it encompasses both the so-called ethical pharmaceutical industry, i.e., producers of prescription legend drugs, and the proprietary drug industry, i.e., producers of drugs and medicines for direct over-the-counter sale. It encompasses the activities of the community pharmacist and hospital pharmacist in the dispensing of prescription medication. Finally, it includes the concept of a business in the distribution of drugs, which encompasses the activities of the producer, the dispenser, and also the wholesaler. It is not so strange then that the concept of a trade in the sense of commerce also enters in, viz., the wholesale drug trade. Thus pharmacy, by definition as well as by functional activity, is all three of these things, a profession, a business, and an industry.

What are the characteristics of a profession? The term is becoming a badly overworked one. There have been volumes written on the meaning of a profession, and I would like to quote excerpts from only a few. I particularly like what Dr. Mason W. Gross, now president of Rutgers University, has said:

> A profession is characterized by being self-regulating. It lays down its own code of ethics for its members, and prescribes its own rules and regulations which concern the conduct of the profession itself. A profession is characterized by the fact that it assumes for itself . . . a sense of social responsibility and moral obligation.
>
> . . . a profession becomes a fully fledged and fully mature profession when it does not turn over to others to determine what its moral obligations are but assumes full responsibility both for discovering and for enforcing these obligations itself.

Dr. Roland E. Kremers, in delivering the Kremers Memorial Lecture here in tribute to his father a few years ago, made reference to some characteristics of a professional attitude which are worthy of repetition. Among these he in-

cluded integrity, which implies capacity for the honorable discharge of a trust; and acceptance of the employer's, client's, or public's welfare as one's own, which implies the placing of public service above material gain and the possession of motives which are largely altruistic.

We see in these descriptions the basic problem of pharmacy as a profession, namely, the inherent conflict between social responsibility and material gain. Pharmacists have long faced the problem of professional morality by reason of their dual role as business men and professional practitioners and the divided loyalties and conflicting interests that such a dual role involves them in. It seems almost too much to expect them to measure up to the rigid standard recently set by Dr. R. A. Lyman, Jr., when he said, "Professional status presumes an absolute freedom of action on the part of the practitioner, a freedom unaffected by even the remote possibility of a profit motive."

The late Dr. Edward C. Elliott, who directed the most comprehensive survey that pharmacy has ever had, summarized our problems as a profession. His statement is perhaps more meaningful today than when he originally made it in 1950:

> Professional standards are under the influence of their commercial environment. From this influence have come the five key problems for the survival of pharmacy as a true profession — the problems of education, of economics, of ethics, of collective self-government, and of the relations to other health professions.

Against this backdrop let us look at the two most readily identified areas of pharmacy in its service to the public, namely, the pharmaceutical industry and the community pharmacist. The pharmaceutical industry in this country stands unequaled in the world in its accomplishments. It has been responsible for more dramatic progress in medicine and more effective drugs than could have been dreamed of fifty years ago. In no other industry has there been more contribution to society, more active competition, more energetic research, more rapid growth and, if we are to believe Senator Kefauver, higher profits.

Concurrent with its recent phenomenal growth, we have seen in the pharmaceutical industry a most interesting example of the inherent conflict between social responsibility and material gain. Many of the pharmaceutical companies were started by physicians and pharmacists; while they were businesses that offered products for sale, their distinguishing characteristic was the service which they offered by making available those products which the physician wanted. But with their growth and expansion, with the entry of other companies into the field, and concurrent with the rapid advances in science and technology, the industry has taken on more and more the characteristics of a business, responsibilities to stockholders have become dominant, and the profit motive has become the driving force.

A recent analysis of the industry by a leading financial magazine described its expansion of spending on research and development as giving rise to "creative destruction" of old products and old markets and characterized various companies as holding offensive or defensive positions in terms of their research spending. It pointed out that relative newcomers in the industry with their offensive positions are causing some of the older defensive companies to change

their strategy or face the loss of their market position in the ever-increasing tempo.

These developments are not in themselves a matter for concern. They are to be expected in a competitive industry and can lead only to the benefit of the public when they result in more effective drugs. But some of the practices and policies that have developed as a result of competition in the industry are open to question when measured against the yardstick of social responsibility. The marketing role has assumed a new importance, and the promotion policies and practices have reached new heights of aggressiveness. Companies have learned that physicians respond to the same kinds of emotional appeals that are effective with the general public and are influenced by the same mass consumer advertising techniques. It would seem that, by its very nature and intended use, a drug should not be promoted by the same techniques that are used to sell soap, cigarettes, and beer. In some cases the impression is gained that the physician is motivated to accept the latest drug mainly to insure his own reputation with his patients for being up-to-date in his therapy.

Of the some 400 so-called new drugs that appear each year, not more than fifty or sixty are really new chemical entities. The remainder are modifications and, particularly, combinations of drugs already on the market. This sort of modern "polypharmacy" is reminiscent of the earlier days of "shotgun" prescriptions of some fifty years ago. But, while the old-time shotgun prescriptions may not have done much good, neither were they capable of too much harm. In contrast, in the view of many pharmacologists and physicians, some of the polypharmacy combinations today, in addition to having no rational therapeutic basis, are capable of potential harm.

The widely prevailing industry practice to duplicate drugs already on the market is rationalized on the basis that such competition makes for lower prices. In the words of one of their public relations directors, such duplication "also occurs in the automobile industry, the cigarette industry and, in fact, in about any American industry you could mention." That statement reflects all too clearly an attitude of the ethical drug industry that manifests itself in so-called new drugs that involve changes no more significant than the chrome trim on the latest model car or the latest filter tip innovation. The unique trust which the drug industry and its products enjoy would seem to impose a special obligation on its companies to expend their efforts in more fruitful ways in the search for new drugs.

The conflict with social responsibility in the pharmaceutical industry is further illustrated in the hundreds of proprietary medicine manufacturers in this country who promiscuously advertise and vigorously promote the indiscriminate sale to the public of non-prescription, over-the-counter drugs which encourage self-diagnosis and self-medication. They attempt to draw a cloak of respectability about themselves with their exhortations that they are providing beneficial home remedies for mankind's lesser aches and pains. Despite this, the impression persists that their primary motivation is commercial rather than professional and their efforts appear to be limited only by the fertile imagination of the advertising man and the latest discoveries in motivational research. From a study of the techniques that have been used in recent years, it is apparent that the ethical drug manufacturers have been guided by similar advice in the promotion of their products to the medical profession. Even more significant, many of the ethical manufacturers, through merger, ac-

quisition, or other means, have entered the proprietary field with their own products; others are struggling with the decision of whether to follow the same path in coping with the problem of loss of their market position in the ethical drug field.

Now let us look at the community pharmacist from whom the public gains the greater part of its impression of the whole field of pharmacy. He is perhaps in the greatest professional dilemma of all. Much of his difficulty is of his own making, but a significant part of it appears to be due to factors that are beyond his control. In the matter of proprietary medicines he is eager, on the one hand, to appear a professional in the eyes of the public and is somewhat troubled by the thought that his cooperation in the promotion and distribution of these products, which are presold by mass media advertising, does not add to his professional stature. On the other hand, he suffers economically in the loss of this business to nonpharmacy outlets. And his professionally motivated attempts to regulate the distribution of these proprietary medicines, in the interest of public welfare and safety, are attacked by the manufacturers as being motivated solely by economic interest.

In his prescription practice the community pharmacist wants to fill his rightful role as professional consultant to the physician on all aspects of drugs. But all too frequently he faces problems here, also. Some pharmacists do not have adequate background to do this effectively and are unwilling to make the effort and sacrifice to acquire the necessary background; others who have the background through their academic training and experience do not make use of it. In some cases the pharmacist is frustrated by the unwillingness of the physician to accept him as a professional consultant.

Of even greater concern, the pharmacist seems to have become the captive of a system of promotion and distribution which in its evolution has appeared designed to make him nothing more than a passive distributor of drugs. Some years ago I stated that there was an impending danger of the community pharmacist being reduced completely to the status of a purveyor of pre-fabricated, presold, and prepriced medication to the public. Economic, political, and social forces have contributed to that evolution. The pharmacist, unfortunately, also has contributed to it by his preoccupation with the economics of his position in distribution, his failure to emphasize sufficiently his professional role, and his willingness to embrace the commodity concept as opposed to the service concept in his professional practice.

We are now faced with attempts by forces outside the field to establish pharmacy as only a trade rather than a profession. The latest and most serious are the attacks by the U. S. Justice Department in Arizona and California, where pharmacists are being accused of prescription price-fixing through use of prescription pricing schedules. In the latter case the pharmacist has been referred to by the Justice Department as being "licensed to *sell* prescription drugs."

Adding to the pharmacist's woes are such additional developments as mail-order prescriptions, counterfeit drug distribution, discount prescription operations, substitution, and similar schemes which represent a perversion of the profession. All of these are a reflection of the concern of too many pharmacists for material gain only, with no concern for the safety and welfare of the public which they serve.

A summary diagnosis of the current situation in pharmacy would indicate its cause to be in the unprecedented ad-

vances in research and science coupled with aggressive policies of promotion and distribution which have led to seemingly unlimited privileges and advantages. The tempo of this development has been so great that pharmacy has not taken the time to consider fully the social obligations that must be a part of its unique position of public trust and confidence. It is time now for pharmacy, both profession and industry, to take stock of its situation, to become aware of its social obligations, and to take the steps necessary to secure its future.

There is nothing inherently wrong with the dualistic nature of pharmacy as reflected in its business and professional character. To paraphrase the statement of Dr. Lyman, it is only that the ethics, motives, and aspirations that are acceptable in its business character are different from and, to some extent, incompatible with those of a profession. It is with the correction and neutralization of the effects of those incompatibilities that we must continually concern ourselves.

It is common practice today to refer to the profession of pharmacy and the pharmaceutical industry as two areas that are separate and distinct. But I do not believe that we as pharmacists can disassociate ourselves from those among us, whether they be producers, distributors, or dispensers of drugs and medicines, whose philosophies, objectives, and practices do not bring credit to our profession. Certainly such distinction is not made by the public whom we serve. Neither do I believe that we are compelled to remain silent, when our silence gives passive approval to those same philosophies, objectives, and practices, if we support the belief that a profession should be self-regulating.

The future is not as dark as this look at ourselves might indicate. Strength is born of adversity, and already there are signs of developments that are hopeful for the future. One of these is the growing realization of and emphasis on the need for a change in the promotion, distribution, and pricing philosophy of the pharmaceutical industry, along with the professional fee concept in prescription pricing. If this replaces the prevailing profit margin and commodity concept of prescription service, it not only will solve some of the pharmacist's public and interprofessional relations problems but also will strengthen his position as a professional person.

Another is the growing awareness on the part of the pharmacist of the absolute necessity for unified effort through organization, in the interest of professional survival. The demands for one voice for pharmacy are more frequent and more vigorous than ever before. Still another is the realization that the alternative to effective self-regulation is federal control. Partly as a result of the Kefauver hearings, the pharmaceutical industry is now faced with that possible alternative. The community pharmacist is more fortunate in having a built-in mechanism for self-regulation in the existence of his state board of pharmacy. It has been said that the practice of pharmacy in any state is only as good as its board of pharmacy. The conscientious pharmacist is learning that, in the interest of professional survival, he must provide the state board with the necessary power and insist upon its use in the control of distribution of drugs, not only for his own protection from the unscrupulous operator but also for the protection of the public.

We should not overlook pharmaceutical education in our self-analysis. The improved and extended educational standards that have been developing during the current century, with emphasis on the sciences and de-emphasis of vocational aspects, have been responsible for raising the practice of

pharmacy from a condition of functional empiricism and placing it on a foundation of scientific professionalism. Graduates of our colleges of pharmacy will be equipped to fill their rightful role as professional people, as consultants to the physician, and as productive citizens in their communities. But this will not happen automatically, and the mere awarding of the diploma will be no guarantee of it. It will happen only if the pharmacy graduate is willing to make use of his training to give professional service, to build on the foundation he has received, and to continue his education through self-study and attendance at refresher courses throughout the remainder of his professional life.

And what will be the obligations of pharmaceutical education? The five-year curriculum will not solve all of our educational problems. It will provide the graduate with a fairly adequate foundation in the scientific and technical areas. But, what of the general education of the pharmacist? For years there has been a difference of opinion as to the value of the so-called general education courses in the curriculum, and this extends even to the five-year program. I cannot escape the feeling that pharmacy is suffering today from the lack of such courses in the training of the pharmacists whom we have educated in the past.

We are frequently criticized for the lack of "practical" courses in the curriculum. What could be more "practical" for the pharmacist in his present predicament than a better ability to use his native language, orally and in writing, to enable him to communicate more effectively with other members of the health team and with his public in establishing and strengthening his rightful professional role; a knowledge of psychology to understand better and, hopefully, even to neutralize the effects of some of the flamboyant drug promotion philosophies and practices that emanate from Madison Avenue; or a knowledge of economics, sociology, and political science to understand better his position in the changing environment of social, economic, and political pressures to which the health professions are being subjected? It may well be that the future of pharmacy will depend as much upon these things as upon the professional competence of the pharmacist.

Pharmaceutical education must become more alert to the need for greater cooperation between colleges of pharmacy and colleges of medicine, wherever possible, to acquaint our future physicians with the professional services and abilities the pharmacist can contribute and how these can benefit the physician and his patients.

There is one other challenge I would like to see our colleges of pharmacy accept. In no other profession as much as in pharmacy does it seem to me that its destiny is so largely in the hands of people who have had no academic training as a pharmacist. This is due partly to the fact that pharmacy, being business and industry as well as profession, has a natural attraction and a need for people with diverse backgrounds. Another reason has been the shortage of pharmaceutically trained manpower and the funneling of the bulk of our pharmacists into community and hospital pharmacy practice, the only areas which legally require their presence. Still another significant reason, I believe, is failure of our colleges of pharmacy to encourage their graduates to go into these other areas of the field. Whatever the reason, I have the feeling that the system of promotion and distribution as we know it today, and which appears to have made the pharmacist its captive, is partly the result of it.

Wouldn't the professional attitude be more prominent if we had more pharmacists in key positions of influence and

responsibility at all levels in the development, promotion, and distribution of drugs? Whether it be at the manufacturer's level, the wholesaler's level, in personal detailing of drugs to physicians, in public relations work for the industry and profession, in its legal, economic, and social aspects, or as executives of local, state, and national organizations responsible for shaping group philosophies, policies, and practices, I believe we need more pharmacists in control of pharmacy and its destiny.

It is true that the academic training in pharmacy alone would not adequately equip pharmacists to perform effectively in all of these areas. Their training would have to be supplemented in many cases by additional work in business, administration, economics, law, and other fields. Here is the challenge for our colleges of pharmacy to seek out, among their students, those who have the interest, motivation, and inherent abilities, and to encourage and guide them into programs of supplemental training that would equip them to fulfill their potential for service in these other areas for the professional benefit of pharmacy.

What price professionalism? Without offering a specific prescription, I have attempted to indicate to you some of the essential ingredients it must contain. It cannot be prefabricated for us by someone else and particularly not by those in our midst who, by their concern for only the economics of drug promotion and distribution, would appear intent upon lulling us into a feeling of false security which can lead only to the complete subjugation of the pharmacist as a professional.

Our prescription for professionalism in pharmacy must be formulated by all of us, in the profession as well as in the industry, carefully and, at times, painfully, with full awareness and appreciation of the meaning of a profession and the obligations which the label implies: obligations to ourselves, to our fellow professionals, and to the public whom we profess to serve. Perhaps its most essential ingredient for the future of pharmacy is, in the words of Dr. Elliott, a far greater proportion of members who are ever sharply jealous of the high reputation of the profession and who, by their efforts and energetic cooperation, are determined ever to protect and enhance that reputation.

MELVIN W. GREEN*

PHARMACY LOOKS AHEAD

Since the earliest times that certain substances found in nature were recognized as having curative properties, the function of getting these substances into the hands of the ill and injured has been recognized as a social necessity. In earliest time, the persons responsible for this role were not clearly recognized as pharmacists because the health activities were not divided and, in fact, were not even separated from the priesthood in its various forms for many centuries. Possibly the date 1240, when the edict of Frederick II separating pharmacy from medicine was announced, can be taken as the beginning of the pharmacy profession. Certainly from that date it becomes increasingly clear that to collect, manufacture, purify, identify, standardize, distribute, and otherwise make available drug substances to the ill or to those in whom it is desirable to prevent illness has become an activity of the greatest social importance.

These tasks today are clearly assigned to the pharmacist who may be practicing in community pharmacies and other distributive centers, in hospitals, in industry, in government, and in other settings. The pharmacist may be working to a major degree with his hands, he may be largely teaching, administering, or researching, but he is still recognized, or should be, as a pharmacist and is engaged in one or more of these acts that fall within the definition of pharmacy. If someone did not exist to perform these roles, society would have to invent him, for it could not function without him.

For over three centuries society has "officially" recognized pharmacy by setting the pharmacist and his work apart, giving him certain monopolies of function in turn for the protection of the public against improper pharmaceutical practice and spurious drugs. This setting apart of the pharmacist dates back to King James I of England, who in 1617 granted the London apothecaries a charter creating the "Society of the Art and Mystery of the Apothecaries of the City of London" and making it unlawful for non-members of this Society "to make or sell, to compound, prepare, give, apply or administer any medicine or medicinable compositions."

Every state in the United States today has a pharmacy law controlling the making and distribution of medicines, and it is to the credit of American pharmacists that most such laws have their origin in a so-called model pharmacy law agreed upon by the American Pharmaceutical Association in 1869 and made available to the governors and legislatures of the various states. Every nation a part of Western civilization or touched by it to some degree has some kind of pharmacy law, and Urdang

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states, "in some measure the existence or nonexistence of legal regulations of the practice of pharmacy may well be regarded as significant of the degree to which this c i v i l i z a t i o n has been adopted."

From this it follows that there are certain things that society has decreed through due process of law that only properly qualified pharmacists can do. These are social needs, or there would be no necessity to circumscribe the tasks with laws. But there are many other things that pharmacists do which may not be so carefully prescribed in legal terms but which pharmacists are either the only ones who can by training or knowledge do them or at least the only such persons in a position to do them under the circumstances.

Many writers have pointed out the arguments for classifying the occupation of pharmacy as a profession. Without citing all of the reasons why pharmacy is a profession, I think it safe to accept it as such, at least among pharmacists.

If pharmacy is a profession and a socially necessary one at that, then what is all of the shouting about? Are not its goals adequately defined in its social necessity?

It would seem that there may be several reasons for taking a new and hard look at goals for pharmacy at this time. In the first place some people, including some pharmacists, seem to question whether pharmacy is either a profession or a social necessity. This has a deleterious effect on the social and professional image of pharmacy that cannot be permitted to go unchallenged too long. Edward C. Elliott put the matter very succinctly in *The Pharmaceutical Survey,* where he said, "The profession must contain a far greater proportion of its members who are ever sharply jealous of the high reputation of the profession and who, by energetic cooperation, are determined ever to protect that reputation." Recent events in the courts, in the market place, in the committee rooms of Congress, in the press, and in other seats of high council have demonstrated that our chickens of complacency are coming home to roost.

In the second place, the stresses and strains of a changing society coming at a time when pharmacy is not very far into its phase of the industrial revolution tend to obscure the place of pharmacy in society. This problem emerges from the shift of the manufacturing role away from individual pharmacies toward their concentration in industry. To a considerable degree, these two basic problems are interrelated.

It may be profitable to look at certain aspects of the latter problem first. The word *pharmacy* conjures up two images—that of the site of practice and that of the function. At times this dual image interferes with or beclouds issues at the expense of otherwise good logic. To start to talk about the profession and then to let the mental image of a specific pharmacy, particularly a marginal drug store, of which there are admitted to be too many, superimpose itself on the argument often defeats the purpose. By the same token, to revolve discussions of pharmacy, the function, around a particular site of function often has a limiting effect on the discussion that hinders as much as it helps. There is a need for sound thought and depth analysis concerning pharmacy as a function independent of site. Since the function is a social necessity, it can be assumed that it always will take place at some site and the question of the site becomes another problem which could be and should be analyzed separately.

Recently pharmacy (the function) has been defined as "that profession which is concerned with the art and science of preparing from natural and synthetic sources suitable and convenient material for distribution and use in the

treatment and prevention of disease. It embraces a knowledge of the identification, selection, pharmacologic action, preservation, combination, analysis, and standardization of drugs and medicines. It also includes their proper and safe distribution and use whether dispensed on the prescription of a licensed physician, dentist, or veterinarian or, in those instances where it may legally be done, dispensed or sold directly to the consumer."

Every pharmacist practicing his profession is concerned to some degree with each of these elements in the definition although a particular pharmacist by virtue of the location of his practice may need to emphasize some aspects and deemphasize others. But educationally the basic elements of each of these phases must be present in every pharmacist.

By and large these elements were in the professional make-up of a pharmacist, let us say thirty-five years ago, also. The relative importance of the different aspects of the definition was not necessarily the same, and the knowledge and skills included in some of them were at a distinctly different level of sophistication at that time. Take the matter of drugs sold directly to the consumer, for example. While it has always been true that, in the majority of instances, the pharmacist is the only professional contact with the patron, there was a time when this had little professional meaning, for the secret nature of the substance left no opportunity for much professional advice. Today, by law, such secrecy does not exist and, hence, professional handling of such a transaction becomes not only possible, but a professional and moral obligation.

Consider the knowledge of standardization of drugs. The pharmacist professionally engaged in control activity in industry is interested in the detailed technology of standardization because he either carries it out or supervises its operation as part of his job. It is of no less importance to a community pharmacist, who neither carries out the operation or supervises it, however, for his knowledge of the implications of control is drawn upon in reaching decisions of selection and possibly interruption of distribution because of a breakdown in control.

The formulation pharmacist must know a great deal of the science and art of combination. Such physical concepts as pH, dissociation constants, tonicity, biological half-life, zeta potential, kinetics, and many others go into a modern pharmaceutical product. In some instances the industrial formulation pharmacist uses these at a level of considerable depth, and in other cases he performs like the conductor of a symphony orchestra harmonizing the skills of analytical chemists, physical chemists, microbiologists, pharmacologists, and others to create a complex dosage form.

Yes, this is clearly within the function of a specialized formulation pharmacist, but what about a hospital pharmacist or a community pharmacist? Surely these pharmacists cannot perform their evaluative function without this type of background. When the pharmacist is called into consultation by the physician regarding drugs, part of the advice sought is in the realm of pharmacology and therapeutics, part in economics at times and part in pharmacy. The meaning of the pharmaceutical technology involved in such a dosage form is clearly one of the most important phases of the pharmacist's realm. Since many of these drugs have gone through these "physical pharmacy" processes in their development, all pharmacists must have a keen ability to evaluate such developments pharmaceutically and interpret the evaluation to others in modern and objective terms.

In the past, there has been altogether too much focus of attention upon the

fact that 90 per cent of the college of pharmacy graduates are employed in so-called retail practice and a concomitant desire to slant the professionalization of the occupation with that concept in mind. While the ninety-ten ratio still holds essentially constant, such an outlook tends to provide an inadequate background for the ninety and an even less adequate background for the other ten. It should not be lost sight of that the 10 per cent represents over 10,000 and between three or four hundred graduates every year and points up again the necessity for separating function from place.

Another important separation to make is the separation of what the pharmacist does in many cases from what he knows and what knowledge he brings to bear on what he knows. Frequently it is said that the pharmacist only "counts out" and "pours out." Within a limited concept this is true. But an attorney merely transcribes words to a piece of paper and calls it a "will"; a chemist often only makes a weighing, transfers a sample to a machine, pushes a button and takes a reading; a physician only reads a thermometer and counts a pulse; a minister says a few words, asks a few questions and says, "I pronounce you man and wife." To mistake the acts of or the physical results of the activity of many professional people for the essence of their professional function is to reduce much of life to a simplicity that does not exist in reality.

It must be admitted that pharmacy has some unique problems in terms of the public appraisal of its function. The industrial pharmacist, the hospital pharmacist, the pharmacist in the Food and Drug Administration, and others rarely come in direct contact with the patron or his family. Frequently this is true of the community pharmacist as well. When the physician thumps my chest, I know it is my chest that is thumped—it is very personal. A lawyer draws up a will for me; my nerve jumps when the dentist's drill hits near it; it is I whom the minister married, and the marriage certificate says so. I have no difficulty recognizing that a personal service has been provided for me in many such cases.

But the physician calls on me, makes a telephone call to the pharmacy, a delivery boy brings me a package of twelve blue tablets that look exactly like those which I have seen the man next door take and which I have identified as the latest remedy described in a popular magazine. To translate this act into a personal and professional function may not be easy. But before it can be so translated to the public, it is necessary that we be sure that we ourselves know and understand the difference between the professional and personal function and the relatively simple act of transfer.

There are many functions that pharmacists perform between the receipt of the prescription and the counting and pouring operation or even before. Some of these functions are mental and performed so frequently that the pharmacist is scarcely aware of the fact that he performed them, i.e., choosing between two drugs of similar names, selecting the correct dosage form, checking the dose. At times a literature search of considerable depth may be involved as may be a professional judgment calling for considerable weight. It would be of interest to make a list of the many professional functions and services rendered by pharmacists and find the relative frequency with which they are performed.

These are some of the studies that the author believes pharmacy should pursue during the next several years. It would appear that, to a certain extent, every segment of pharmacy should make its contribution to the attainment of the resulting goals. Some of the goals of

clearly defining modern functions and developing professional pride must be attained quickly, even at the risk of half-measures, whereas others must be pursued somewhat more slowly, analytically, and philosophically. Because of the author's educational interests, he is taking the long view of attainment through the educational process by educators with the full realization that others are capable of assistance also and may even provide the final solutions. Educators may assist in such goal attainment in the following ways, among others:

In the first place educators must continue to see to it that professional undergraduate students and specialized graduate students are well prepared at the technical level in such a basic way that all future pharmacists will have the tools with which to practice their profession at any predictable site of practice and regardless of turns the profession may take. This often means a ruthless weeding out of obsolete material, a deemphasis on predigested information, and more emphasis on the student learning to synthesize information for himself.

Secondly, without any material decrease in the teaching of scientific and technical background material, a greater emphasis on professionalization of knowledge is needed. While many of the better students will be able to synthesize information from many sources and perform an evaluative role professionally, many will not. While the information about present drugs is important, much of the most important function of the pharmacist is to evaluate information relative to new drugs as they become available after his graduation. To evaluate, rather than to know, should be the goal, although it is necessary to know certain things before one can evaluate.

Third, those in education are in a position to evaluate more dispassionately the changing functions of the profession, the effects of social and economic forces on the profession, and related matters. In this evaluation they are also in a position to obtain from economists, sociologists, medical educators, and other specialists assistance and advice that will be needed to bring reality to bear without sacrifice of idealism. While it is important for educators to be aware of the times, it is equally important not to be subservient to the times, by building for that portion of the future that bounds the graduate's most important professional years.

Lastly, through contact with the profession, educators should make the practitioners aware of their place in the scheme of things, the trends that are taking place and the influence of these trends upon them with the aim of not only helping to keep the pharmacists in the swim but assisting them to achieve the pride of profession that should be theirs.

BABU N. PATEL*

AN ORGANIC MEDICINALS COURSE FOR PHARMACISTS OF TODAY AND THE NEXT DECADE

The topic "A Course in Organic Medicinal Products" has been discussed in the past at numerous meetings at the local, district, and national level. It will, I am sure, be discussed many times in the future. This reflects the growth and development that the field of pharmaceutical chemistry, like all sciences, is undergoing. Perhaps more than half the growth and history of pharmaceutical chemistry have taken place within the lifetime of our average college student. The requirements we set for today will be wholly inadequate in a few years. As we enter the era of an expanding pharmaceutical curriculum, it is time now for us as teachers to exchange ideas and shape our plans to meet the demands of the next decade. The future of pharmacy will be shaped by what we are thinking now more than by what we are doing now.

The rapidity with which new therapeutic agents make their appearance and those that a few years ago were headliners become obsolete should engage our serious attention in connection with what we teach and how we teach it. The drugs will be ever more potent, and the risk of misuse will be greater. This will augment many fold the demands for increased vigilance on every force that now contributes to our present enviable state of good health. We will be hard-put to meet these challenges. As suggested in the title of this paper, the discussion of the topic will be in two parts with some degree of overlapping. The first part will deal with the present requirements and methods adopted to meet these requirements in the field of organic medicinals. The second part will deal with anticipated changes and new developments in the practice of pharmacy.

By and large, courses in organic medicinal chemistry comprise a study of the nomenclature, sources, methods of preparation or synthesis, physical and chemical properties, structure-activity relation-

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ships, and use of organic chemicals in clinical and experimental medicine and in the fabrication of dosage forms of these chemicals.

Current Objectives

The courses in the chemistry and pharmacy of medicinals offered at different schools and colleges of pharmacy conform, more or less, to the objectives suggested in *The Pharmaceutical Curriculum* (1952) by Blauch and Webster. Listed among the objectives are:

> (1) Understanding of the chemical structure, pharmacological action, and pharmaceutical use of medicinals, and the effect of modifications of structure (isomerism, homology, analogy, isosterism) upon their physical, chemical, and pharmacological properties; (2) Appreciation of future possibilities of new and as yet unforeseen developments in the field of medicinals in the light of past experience; (3) Ability to read and interpret the nomenclature of new medicinal agents and to evaluate the therapeutic claims of competing products; (4) Ability to recognize potential incompatibilities when two or more medicinal agents (official drugs, proprietaries, specialties) are combined and ability to suggest ways of avoiding such incompatibilities.

Methods Used

To achieve the above objectives, teachers of organic medicinal products devote at least some time to the consideration of the following points: (1) official titles and synonyms; (2) selected non-official synonyms; (3) historical development; (4) source and preparation; (5) significant physical and chemical properties; (6) mode of action; (7) structure-activity relationships; (8) uses; and (9) dose.

The teacher attempts to cover these points to the best of his ability and within the limits of the time allotment. One may ask the question: should all these points be covered in one course? There is no question about the desirability if not the requiring of these points in the pharmacy curriculum with additional pharmacology of these drugs. Another question that may be asked is: what should be the proper balance and/or correlation between the chemistry and the pharmacology? The chemistry and pharmacology of drugs, insofar as associations between them have been established, should never be dissociated. The use of a pharmacological classification with chemical classification within such a pharmacological classification in undergraduate organic medicinals has been found to be very effective in my experience. For example, in the study of local anesthetics, the drugs are studied under their chemical classifications, namely, (1) hydroxy compounds such as benzyl alcohol, phenol, (2) esters of benzoic acid and p-amino benzoic acid, (3) amides, amidines, and (4) miscellaneous.

Another debatable question in regard to teaching of organic medicinals pertains to whether there should be a separate course for natural products. It is my belief that at the undergraduate level we should teach all drugs, synthetic as well as natural products, as one course instead of separate courses. In fact, subclassifying drugs as natural, semisynthetic, and synthetic within a pharmacological classification wherever possible adds to the effectiveness of the course. This could be done, for example, with curariform drugs, spasmolytics, antibiotics.

The objectives for the course(s) in organic medicinal products should be and, generally speaking, have been the same regardless of what school one is in, but the method used to attain these objectives would and does differ. Because the methods used in different schools are different, actual results tend to be different, even though unintended.

In the opinion of the author, the results of instruction in organic medicinal products in some instances leave a great deal to be desired. This can be attributed to lack of motivation of students or to the ineffectiveness of the method adopted. As a teacher, one must try to help each student associate himself with that which is to be learned. To do this demands more than sitting and listening to lectures. He must become an active participating part of the total learning situation.

Additional Objectives

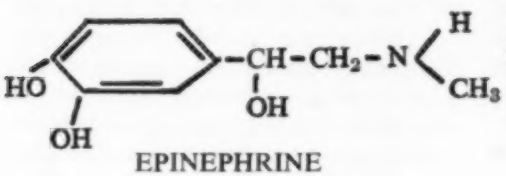
Besides the achievement of objectives enumerated before, methods adopted in the instruction of organic medicinal products should help achieve the following:

1. To establish a strong bridge between organic chemistry and pharmacology.
2. To fire the spark of investigative interest in the present students, some of whom will become the investigators of tomorrow.
3. To give the student a working knowledge suitable in dealing not only with the commonplace problems facing a pharmacist but also with the new and unusual problems appearing with increasing frequency in the expanding pharmaceutical technology of today.
4. To help the pharmacist become less the handmaiden of the physician and more the therapeutic consultant.

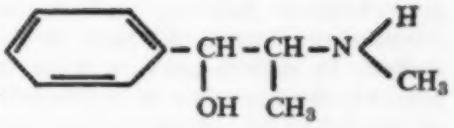
At this point, I should like to introduce one example of the method I use as a means of achieving the total objectives suggested thus far in this paper. Let us take the subject of sympathomimetic drugs. In this instance as in any other, the most useful knowledge of organic medicinal products is that which has been integrated about structural formulas. In presenting lectures, assigning reading, and giving examinations, I strive to emphasize the importance of the correlation of structure with the following: (1) nomenclature, (2) pharmacologic properties, (3) physical properties, and (4) chemical properties.

One or two well-established drugs, usually natural drugs which can be considered as "prototypes" for the class of compounds being discussed, are studied in the manner shown below for ephedrine and epinephrine.

Amines Having Sympathomimetic Activity



EPINEPHRINE



EPHEDRINE

I. *CHEMICAL COMPARISON AND CONTRAST*

1. Has beta phenylethylamine structure	1. Likewise
2. Is a secondary amine	2. Likewise
3. Has OH on beta carbon	3. Likewise
4. No substitution on alpha carbon	4. Has a CH_3 group on alpha carbon
5. Phenolic OH groups	5. No phenolic OH groups

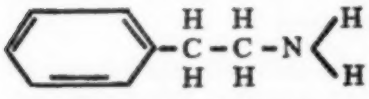
II. *PHARMACOLOGICAL COMPARISON AND CONTRAST*

1. Vasoconstrictor action	1. Likewise
2. Short duration of action	2. Longer duration of action
3. Vasoconstriction frequently followed by vasodilation	3. Not the case
4. No significant CNS stimulation	4. More pronounced CNS stimulation

III. *PHARMACEUTICAL COMPARISON CONTRAST*

1. Inactive orally (two-carbon chain is susceptible to amine-oxidase)	1. Active orally
2. Easily oxidized and quite rapidly in alkaline solutions, therefore unstable.	2. Instability due to effect of light but not oxidation; it darkens and decomposes.
3. Protect from oxidation by addition of anti-oxidants, Ex: Na Bisulfite	3. Protect from light by storing in light resistant containers.
4. Base is insoluble in HOH	4. Base is soluble 5 per cent in HOH

Beta phenylethylamine structure may be altered in four major ways



beta phenylethylamine

1. Phenolic hydroxyl substitution in the aromatic nucleus
2. Substitutions on the beta carbon atom
3. Substitutions on the alpha carbon atom
4. Substitution on the amino group

Synthesis of ephedrine and epinephrine further help to establish the structural formula in the mind of the student. In each instance, it helps to point out the possibility of synthesizing the analogues by selecting the proper reacting substance in one or more steps of the synthesis.

Once the structural formulas for the "prototype" compounds have been fully understood by the students, a discussion of the effect of modifications of structure upon their physical, chemical, and pharmacological properties is taken up. This permits the study of additional examples of the pharmacological class of compounds being studied. Use of the prefix "nor," "desoxy," "neo," etc., helps study additional compounds.

This approach offers the following advantages:

1. It reduces the need to learn structural formulas by rote memory.
2. The student understands the need for several agents with the same basic pharmacological activity.
3. The student is stimulated to think in terms of what future developments are possible in respect to the class of compounds being studied.
4. The student can appreciate the relative merits of several drugs with the same pharmacologic action.
5. The student is more likely to remember the information beyond his college years. This is very important when it comes to recognizing the chemical nature and merits of new drugs that appear.

The Future

With respect to the changes the next decade may bring about in the general practice of pharmacy, the following may be cited:

1. Rapid growth of the pharmaceutical industry will result in an even faster rate at which new therapeutic agents will appear on the market. The research will continue toward greater specificity both in drugs themselves and in the prescriptions calling for them. This will increase steadily the demand made upon the pharmacist to inform himself so as to serve better as the physician's consultant on pharmaceutical matters.
2. Possibility of fifteen to twenty schools going on a six-year program, thus introducing into the practice of pharmacy individuals with a much broader and deeper training in pharmaceutical chemistry. This may have the effect of pharmacy's becoming a "two-level" profession—the service drug store comparable to the general practitioner in medicine, and the prescription pharmacy comparable to the specialist in one of the branches of medicine.
3. Rapidly growing number of hospital pharmacies. This will increase the demand for the pharmacist who will have to know more and more in the field of medical science. He will have to be the man who was educated in such a manner that he can understand the constant changes that will occur during his years of practice.
4. Possibility of appointing a professor of pharmacy and therapeutics on the faculty of medical schools. This will necessitate a supply of additional pharmacists with sound training in organic medicinals.
5. Appearance of superpharmacies where emphasis will be on non-pharmacy items. The pharmacists

with inadequate knowledge of the newer therapeutic agents may be relegated to such lesser jobs.

6. New shop arrangement plan which will provide for the separation, not only of the prescription laboratory but also of all the drug preparations, sickroom requisites, dressings, and other professional items, from the store proper may come into being. The "older" pharmacists may have to be relegated to non-prescription work, and the "newer" pharmacists with knowledge of modern therapeutic agents may find better opportunities.

Some of the above may be speculation. None the less we are all interested in having in the corner drug store, the hospital, the armed services, and our pharmaceutical manufacturing plants men and women who will be thoroughly trained in the handling of medications of their times. This can only be achieved by giving those aspiring to practice pharmacy in the next decade and beyond an adequate educational background. Pharmacy is progressing steadily in manpower and outlets and is progressing mightily in every other phase of its operation.

Whether we like it or not we must all remember that we have been born into this period of changing times, this period which is offering its challenge to every person's existence. The pharmacist will have to accept the challenge it presents, and further, he will have to become better fitted to deal with the material coming from the researchers' test tubes, chromatographs, and molecular models.

WALLACE GUESS AND JOHN AUTIAN*

TEACHING MACHINES AND PHARMACY**

Whether one teaches in an elementary school, a secondary school, or in a university, he soon becomes aware of the many tasks which fall upon his shoulders of a nature quite remote from that of actual teaching. Even though this practice may be more prevalent in the non-college atmosphere, where the teacher's time is budgeted to actual activities from the time he enters the school until he completes his last afternoon class, the college instructor still has many of the same routine mechanical chores to perform as his brother or sister elementary or high school teacher. Whereas the non-college teacher usually can bring most of his teaching duties to an end in the afternoon, the college teacher usually must continue his scholarly and research activities into the evening and into the weekends in order that he may maintain his academic status on the college faculty. In recent years, the expanding population entering college level of instruction has also added to the festering problem of the teacher. Larger classes with fewer teachers per number of students obviously diminish the instructor's time to cater to the individual needs of the student. The future seems even more bleak than the present since within a decade the college population will double.

Colleges of pharmacy are facing the same problem. In many instances, their problems will grow even worse in comparison to the other branches of the university community because industry and private practice will, undoubtedly, tempt many potential faculty members away from academic life. This trend can already be noted in a number of schools where positions are vacant or, for a stopgap measure, less qualified or less suitable instructors are used.

Need for Teaching Efficiency

What has been said should point up the problem mass education is facing on a college level. On the one hand, more students with a wider range of academic interests are entering the colleges, while, on the other, the rate of increase of teachers in proportion to the number of students is decreasing. The pursuit of excellence in American education (and, of course, including pharmaceutical education) is fast being jeopardized by the lack of individual student attention. It is essential that means be found in the future to permit teachers to give greater attention to the individual student while teaching an ever-increasing number of students. One approach which many educational psychologists believe will help the state of education is to increase the efficiency of both the administration and the faculty of our present universities. This certainly would be a step in the right direction, but, unfortunately, this approach would not give the total results needed to stave off educational decline.

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**Presented to the A.Ph.A. Section on Education and Legislation, Chicago, 1961.

New and, yes, radical departures in teaching methods will have to be initiated to achieve the ideal efficiency required for education in the future.

In recent years, there has appeared on the educational horizon a teaching method which, if developed and nurtured, could give the efficiency and the answer to our future teacher shortage. This method is referred to as "auto-instructional procedures," more commonly called the "Teaching Machines."* The remaining portion of this paper will attempt to review this concept and to suggest its possible value in pharmaceutical education.

Suspicious Attitude

At this point it is wise to direct our attention to the term teaching machine, since it has in the minds of many lay people, as well as many pharmaceutical educators, a sinister implication. Immediate reaction to the term by those not properly oriented to the teaching machine is that a mechanical monster will automatically take the student away from a human influence and, by some form of manipulation, will produce a robot-like creature completely devoid of personality and human attributes.

Much of the confusion in regard to the teaching machine has developed from the popularization of the subject in the lay press. Invariably, the articles contain headings such as "Learning from Machines" or "Machines Will Teach Your Children." Of course, this type of news distorts the truth and is written to appeal to the universal desire for entertainment of the public. In these same news stories or features, there are also allusions to a number of experimental studies conducted by psychologists on animals whereby the behavior of the animals was controlled by certain stimuli. From these basic experimental studies, the news reporter creates further appealing headings such as "human beings learn like pigeons." This type of popularization has also been followed by teachers, especially those not acquainted with the "teaching machine" concept, and, in turn, some of these teachers have developed a critical bias against auto-instructional procedures to the extent that they wish no further thought on the subject.

It is thus best to calm those teachers who are in dreadful fear of the teaching machine by saying unequivocally that no machine now, or in the future, will teach. The machine, however, can aid the teacher by presenting a subject matter to the student in such a way that the student will be able to learn more efficiently.

Underlying Principles

To prevent any misunderstanding in this early approach to the subject at hand, let us consider the teaching machine as a concept rather than just a mechanical contrivance. This will be a wise course since it will allay the apprehensive feelings of certain faculty members that machines will replace human beings.

Even though the teaching machine is of modern times, one of the principles used to support the concept can be traced back several thousand years to perhaps one of the greatest teachers of all time, Socrates. This wise and learned man, so the story goes, would teach young men in his community, on an individual basis, the then known theory and knowledge. Socrates would describe or explain a portion of the subject and would then seek an answer from the

*A most excellent and comprehensive review on the subject of Teaching Machines may be found in a new text: *Teaching Machines and Programmed Learning*, Lumsdaine, A. A. and Glaser, R., National Educational Association, Washington, D.C., 1960 (cost $7.50). Also a new journal devoted to the teaching machine is now published, titled *Automated Teaching Bulletin*.

student concerning what had just been described. If the student could not respond correctly, then Socrates would not introduce any new material but would instead give further information to help the student compose the correct answer. By this method of presenting the subject in small bits and eliciting a correct response from the student, Socrates was able to teach the student the most difficult subject matter with an amazing degree of effectiveness. Of course, today we recognize Socrates' approach as the tutor system, a system which is still one of the most powerful teaching techniques when administered properly.

From the golden age of Socrates down to the present, researchers have compiled their theories of learning, and their collective opinions appear to support that the learning process is dependent upon a number of forces which, if made to operate in a specific manner, will facilitate learning. Much of modern-day evidence for the learning process in man has evolved from exhaustive controlled experiments on animals by research psychologists.

Skinner (1) and his group have investigated for many years the behavior of animals in a controlled environment and noted that animals could be made to do a number of remarkable feats if the animals were properly conditioned. For example, if a rat was placed into a cage having two doors, one leading to food or water and the other leading to an empty cell, the rat would eventually be conditioned to know that it should enter the door leading to the food or water. Once the animal learned to make the correct movement, another conditioned situation was added to the experiment, and in a period of time, the rat added another performance to his expanding repertoire. This step-by-step conditioning of the animal could lead to practically any type of performance which the investigator desired.

The experimental efforts of Skinner and others demonstrated that the immediate environment will influence the behavior of an animal. This particular influence is known as the *stimulus*. The particular behavior of the animal to the stimulus is considered as the *response*. Now if the same behavior pattern of the animal is strengthened by another stimulus from the environment, then the response of the animal is *reinforced*. These three factors—*stimulus, response,* and *reinforcement*—are perhaps the most important basic factors in the learning process.

If we look at the rat again we can say that the stimulus was the need for food or water, the response was the movement of the animal through one of the doors, and the reinforcement took place when the animal found the food or water by entering the correct cell.

Even though we have used the term "learned" in discussing the rat's performance, it is generally conceded that the animal is not really learning but rather performing step-by-step movements due to the proper sequence of stimuli. Human beings are not rats, but, surprisingly enough, the stimulus-response-reinforcement forces can be made to play an active role in the learning of a subject by a pupil. Consider once again Socrates and his method of teaching (tutor system). Here the stimulus was the presentation of small portions of information to the student, while the student's answer was the response. Finally, the reinforcement was the knowledge that the pupil was correct.

It is now generally considered by educational psychologists that the student should take an active part in the learning process and that learning is

facilitated if a response is elicited from the students. The student should also have an immediate feedback that his answer is correct or incorrect. Correct responses are more rewarding and appear to help the student learn in contrast to incorrect answers which might serve as a form of punishment. In fact, much work of Skinner's supports the thesis that punishment should not be used, since it may hinder rather than help the learning process.

If such forces as stimulus, response, and reinforcement appear to be the important factors in the learning behavior, then it would seem that subject matter could be organized in such a manner that "bits" of the subject could be presented to the student. The student would then be made to respond at the end of each "bit" with an answer. If the answer is correct, then a new segment of the subject matter would be introduced and the student would continue until the subject matter was completed. Unfortunately, mass education permits little attention to the individual student, since the teacher has not one student to teach but a great many, and thus the customary lecture method is used for the most part in present-day teaching. The student has little opportunity to take an active role in the learning process. To help the teacher, a number of teaching aids and demonstrations are utilized, and, of course, these do undoubtedly aid the teacher and the students if the teaching aids are properly employed. Yet the teaching aid often consists of utilization of only one of the forces, stimulus, while the other forces are absent. However, if the teaching aid could be used in such a manner as to elicit a response from the pupil, while at the same time revealing that the response was either right or wrong, the device could, in a true sense, be a "teaching machine."

We have now arrived at a point where some respectability can be placed on the term teaching machine, and a definition is now in order. For this definition, we have been obliged to borrow the words of Dr. John W. Blyth (2), professor of philosophy at Hamilton College, and an expert in the field of auto-instructional procedures, who states the following:

> A teaching machine is simply a mechanical device for presenting a succession of instructional items requiring some discriminative response and providing the student with an immediate check on the accuracy of his response.

Even though Dr. Blyth explicitly states a "mechanical device," the definition of teaching machines has been broadened to include any type of device which will present the subject matter in atomized form and then require an immediate response from the student before the next frame of information is given. The failure of the device as a teaching machine will most likely be due to the fault of the organization of the subject matter or the *programming* of the subject matter. We will come to this phase of the teaching machine shortly, but before we do let us review briefly the history of the teaching machine.

Pressey to Skinner

Even though teaching machines are of recent times, the actual birth of a mechanical contrivance to help the student learn was developed over thirty years ago by a young educational psychologist at The Ohio State University. In reporting his apparatus in a publication, Dr. Pressey titled his paper, aptly, "A Simple Apparatus Which Gives Tests and Scores—and Teaches" (3). Dr. Pressey's original intention in developing his machine was to relieve the teacher of countless hours of routine

marking and grading, but at the same time the machine served to help the student learn. Pressey's machine was about the size of a typewriter. It contained a window which exposed a question and a choice of several answers. The student would select the answer that he thought was correct by pushing down on a key (analogous to a cash register key). If the answer was correct, the machine rolled a new question into view and the student continued as before. If the answer was not correct, then the machine did not permit a new question to come into view. All tries at the machine were recorded, however, so that at the end of a specified series of questions, the teacher could see at a glance how the student progressed.

Even though Pressey's machines were a real educational innovation, little serious attention was given, apparently, to this idea, and soon his work fell into oblivion. Perhaps the times were not quite ripe to introduce the teaching machine concept, since in 1929 the great depression set in, and unemployment in all fields reached an unheard-of height in the early thirties. The temperament of the nation was not quite attuned to having "machines" replace human teachers, and it remained for the war years to usher in once again the teaching machine concept.

The Second World War suddenly brought a realization that a whole population had to enter the productive efforts of the country in defending and challenging the enemy on two sides of the ocean. There was an emergency need for brain and manpower to operate all the existing and expanding technological devices, both in military life and in civilian life.

Pressey's ideas and philosophy on automated teaching were resurrected, in part, during these war years and many teaching aids (closely resembling the teaching machine) were suddenly ushered into practice. The training of millions of workers and armed forces specialists to operate complex equipment in minimal time was achieved.

After the war, a number of educational psychologists continued their interest in the learning process and continued their studies in laboratories in various colleges and universities throughout the country. Many of their results and conclusions were presented to their own professional societies and eventually published in the official journals sponsored by these societies. It was, however, a scholarly paper by the previously mentioned Dr. B. F. Skinner (1) in *Science* in 1958 which literally opened the door to the surge of interest and enthusiasm for the teaching machine in educational circles. Since then, experimental studies have been initiated in a number of departments in numerous schools throughout the country testing the worth of the teaching machine.

Programming

One or two words have already been said on the subject of the program or the programming.* Purposely, this aspect of the teaching machine has been omitted in detail until now in order to emphasize its importance and to spend some time in elaborating on certain methods of programming which are currently employed. The teaching machine is just a machine with the use of a program. The program is the heart and soul of the machine, and without it no machine, no matter how costly or how intricate it may be, can function. If the program is an inferior one, then by all means the efficiency and effectiveness of the teaching machine are also substandard. This point cannot be stressed

*Technically, the term program means the full set of questions or statements covering the subject. In this paper, program and programming are used synonymously.

enough and should indicate to those who are still fearful of the teaching machine that, in reality, the program or the programming is the key to the success of the teaching machine. This program must be made by human beings.

The program is the actual subject matter broken down into small segments called frames. Each frame contains some information about the subject which the student reads. This is, of course, the stimulus which we referred to earlier. The frame also contains some form of question or statement which must be answered (response) by the student. Once the response is made, the answer is revealed in some particular fashion and the student is permitted to continue to the next frame. The feedback (answer) reinforces the student's learning behavior.

Various types of machines have been designed to feed the program to the student. A number of other features can be incorporated into the machine to help the teacher and the student gain further service from the program. For example, it is possible to have all the answers recorded, which then can become a record of the student's progress in that particular course using the program.

The programs or the programming should be composed in a fashion which presents the subject matter so that the student will have little difficulty in understanding and will thus be able to respond with a correct answer for each frame. Careful arrangement of the subject will guide the student in a step-by-step progress from relatively easy subject matter to the more difficult phases of the course. This is not really much different from a well-prepared lecture or a well-written textbook. The difference, however, is that the lecture or the conventional textbook does not have any responses or reinforcements in the same sense as the program.

At present, there are two types of programs which are in actual use, the Skinner and the Crowder methods. The most used is referred to as the *Skinner type* or the linear type of programming. The main emphasis in the writing of this type of program is to make the frames so simple that the student will invariably get the correct answer each time. Skinner feels that the student receives a form of reward by knowing that he has composed the correct answer. An example of this type of program is seen in Table I for a high school physics course. The program is fed to the student by a suitable device which permits the appearance of one frame. An answer is composed and written in an appropriate blank. The student then actuates the machine which reveals the correct answer while at the same time moving the program to the next frame.

As has been mentioned, a program need not have a mechanical device to feed it to the student. For example, programmed textbooks can be written, or each frame can be placed on a card. The student answers each frame and then turns the page or card to see the correct answer. Table II demonstrates a textbook form of programming by the Skinner method. The programmed text would look like an ordinary textbook except that the student reads the first frame on the first page, gives an answer, and then turns the page to see the second frame. The feedback or answer (for the first frame) also appears in the second frame. This method of a frame on each page with the answer on the following page is continued throughout the book.

While the Skinner type of programming is considered a linear form (one frame follows the previous one consecutively), the *Crowder type* is a non-linear form of programming. Dr. Norman

Crowder (4) perfected his non-linear form of programming while with the Army Air Force, and, since leaving the service, he has written a number of programs using his own type of programming. The Crowder method consists of essentially the same type of frames except that the questions are of a multiple choice variety. Once the student selects an answer, the program informs him whether he is correct, and, if so, it permits him to continue to the next frame. In case the student is not correct, the program will not permit him to continue, but instead an explanation is given indicating why the selected answer was wrong. The student is then instructed to go back to the original frame and once again make a response. Crowder's programs thus may shift the student from one frame to another without the usual one, two, three, etc., sequence employed by Skinner. This method, because of this non-linear approach, is often called the *branching type* of program. As with the Skinner types of program, Crowder programs can be fed by machines or they may be in a textbook form. Table III demonstrates an actual page from Crowder's text on computers.* The student reads the page and is then asked a question which he must answer from the two possible choices of answers. If the student selects "Yes" for the answer, he turns to page 48 in the text and is informed:

> YOUR ANSWER: Yes
>
> You are correct. If we multiply two powers of the same base, we get a product which is a power of that same base. So we can say that if 3^m and 3^n are two powers of 3, with exponents m and n, then their product is also some power of 3—with a different exponent, of course. So our problem boils down to simply finding the exponent of the product.
>
> Now we . . .

The student thus enters the next frame. Had the student selected answer "No," he would turn to page 55 and find:

> YOUR ANSWER: No
>
> Well, let's start with a simple example. Suppose we multiply 3^1 by 3^1. The result will be
>
> $$3 \times 3 = 3^2$$
>
> will it not? And 3^2 is a power of 3.
>
> Now, consider multiplying $3^2 \times 3^1$; that is $(3 \times 3) \times 3$. This will result in
>
> $$3 \times 3 \times 3 = 3^3$$
>
> which is also a power of 3.
>
> If we multiply 3^3 by 3^2 we will get $(3 \times 3 \times 3) \times (3 \times 3)$ which will be
>
> $$3 \times 3 \times 3 \times 3 \times 3 = 3^5$$
>
> won't it?
>
> In each case the product will be a number that can be reached by using 3 as a factor a sufficient number of times, and, therefore, will be some power of 3.
>
> Now return to page 41 and choose the right answer.

Crowder's texts are now sold under the name of *TutorText* and, at times, these books are referred to as scrambled texts, since the student may move forward or backward in the book depending upon the answer he gives.

Even though active research is not taking place to evaluate the superior merits of one type of program over the other, little definite information has been assembled up to this point to indicate that one form of programming

*Published by Doubleday & Company, Inc., Garden City, New York, 1960.

is superior to the other. The consensus of a number of educational psychologists is that perhaps both are of equal merit if the actual materials in the programs are equally good.

Undoubtedly, the writing of the program for any type of course will be the most difficult work to be undertaken by those interested in the teaching machine. Usually, it will be a teamwork project containing a subject expert (the teacher), an educational psychologist, and an experienced program editor. It seems likely, however, that a subject expert who has learned to do some form of programming could initiate the writing of a program. A good programmer must follow the pedagogical steps of a good teacher and must be sensitive to the student's ability. The programmer must also really know his subject matter—a fact which, at times, is not necessarily true of all teachers. In the initial phases of the writing, the programmer could just construct his own frames and place these on cards with the answer on the back side of the card. These cards could then be tried on students, and, by observing the efficiency of the students, the programmer could modify or add frames so that an easy step-by-step progress might be made by the students. Once the subject matter is programmed in this way, the programmer is ready to try his program on a larger group of students—but still in an experimental manner. At this point, he might solicit the aid of an educational psychologist and might even use some form of teaching machine such as a projector and flash the frames on the screen while the students compose an answer at their desk.

Finally, after this type of trial and error writing, the programmer is ready to polish his program and may even want to have it published in a text form or in a form to use for a specific type of teaching machine. What has just been stated probably is an oversimplification of a difficult feat, but the results should be quite rewarding to the teacher and to his students.

Teaching Machines

It is hoped that by this point in the paper the reader has become somewhat familiar with the teaching machine concept. Furthermore, the reader should understand that the "machine" is just a method of presenting the program to the student and in no way really teaches. The program does the teaching, and a good program has been based upon well-established learning theories.

At the present time, a number of commercial teaching machines are available costing from twenty dollars for the simplest mechanical device to ten thousand dollars for a computer type of machine which can perform a number of services. The selection of a machine will entail a great many considerations and should certainly not be done in haste. In fact, it is suggested that before a machine is purchased one first develop a program or get a program which can serve as a model.

Motivation

A number of objections have been given to the teaching machine, one being that since a teacher is not involved the student cannot be motivated. In other words, what will keep the student moving from one frame to the next without boring the student? An answer to this question is that a properly constructed program should be "motivating." It should also be remembered that the student becomes an active worker in the learning since he is required to respond, and this active participation will encourage the student to continue. Finally, on a college level, the student recognizes that he is in school to gain mastery of subject matter before he can expect to graduate, and this cer-

tainly adds or should add a degree of motivation.

Teaching Machine in Pharmacy

The colleges of pharmacy are certainly no different from other disciplines now investigating the teaching machine. Already the shortage of good pharmacy teachers is apparent, and the future appears to hold little in the way of supplying us the needed numbers of teachers. There should be no fear that the machine will replace the teacher. The computer certainly did not replace the mathematician. The teaching machine will actually release the teacher from many of the routine chores and will permit him to spend more time in creative and scientific activities. Many basic subject matters now taught could be partially programmed. The students could then gain this basic background at their own speed by the use of the program. The rest of the class time could be spent in discussions or other activities which would be richer and more meaningful to the student. In our present five- and six-year programs, we will have a number of our students coming from junior colleges with perhaps some deficiencies in certain courses. A screening test could indicate that the student needs more background in this or that course, and, if so, the student, on his own time, could take the course by the use of a teaching machine. Countless other possibilities for improving our educational system in pharmacy become likely with the aid of the teaching machine. A time has now been reached when pharmacy educators, individually and collectively, should explore the great potential of the teaching machine. The authors recommend that the AACP give serious consideration to the suggestion.

Summary

The mounting college population necessitates a new look at our educational system. While student numbers increase, the numbers of qualified teachers decrease per number of students. The unfortunate situation has developed and will continue to develop which reduces the personal attention a teacher can give to each student by the usual lecture method of teaching. There is a need for a revolutionary method of teaching which will give the efficiency and effectiveness whereby more individual attention can be given to each student at a time when each teacher will have more students in his class. It appears that the teaching machine concept may make this desire a reality. The colleges of pharmacy are also faced with the same problem, and it is hoped that this paper will encourage the leaders in pharmaceutical education to explore the possibilities of the teaching machine.

Table I
An Example of a Program Based Upon the Skinner Method in High School Physics*

Sentence to be Completed	Word to be Supplied
1. The important parts of a flashlight are the battery and the bulb. When we "turn on" a flashlight, we close a switch which connects the battery with the _____.	bulb
2. When we turn on a flashlight, an electric current flows through the fine wire in the _____ and causes it to grow hot.	bulb
3. When the hot wire glows brightly, we say that it gives off or sends out heat and _____.	light
4. The fine wire in the bulb is called a filament. The bulb "lights up" when the filament is heated by the passage of a(n) _____ current.	electric
5. When a weak battery produces little current the fine wire, or _____, does not get very hot.	filament
6. A filament which is less hot sends out or gives off _____ light.	less
7. "Emit" means "send out." The amount of light sent out, or "emitted," by a filament depends on how _____ the filament is.	hot
8. The higher the temperature of the filament the _____ the light emitted by it.	brighter stronger
9. If a flashlight battery is weak, the _____ in the bulb may still glow, but with only a dull red color.	filament
10. The light from a very hot filament is colored yellow or white. The light from a filament which is not very hot is colored _____.	red
11. A blacksmith or other metal worker sometimes makes sure that a bar of iron is heated to a "cherry red" before hammering it into shape. He uses the _____ of the light emitted by the bar to tell how hot it is.	color
12. Both the color and the amount of light depend on the _____ of the emitting filament or bar.	temperature
13. An object which emits light because it is hot is called "incandescent." A flashlight bulb is an incandescent source of _____.	light
14. A neon tube emits light but remains cool. It is, therefore, not an incandescent _____ of light.	source

*The machine presents one item at a time. The student completes the item and then uncovers the corresponding word or phrase shown at the right.

Table II

An Example of a Programmed Text Based Upon the Skinner Method for a Course in Drugs and Solutions*

	1. METRIC SYSTEM—In order for the nurse to prepare and administer drug products, she must first have a thorough understanding of the system of measurements. In the next section, you will become familiar with the most important system of measurements used in medical practice, the Metric System.
no	2. In any system of measurements, the smallest quantity (as a whole number) is called a unit. In the *metric system*, the *unit* of Length is the *meter* (M). The roll of gauze has a length of 50 meters. Is "50" the unit? _____
100	3. The roll of gauze has a length of 50 meters (M). The unit, of course, is the meter. Actually what we are saying is that the roll has a length 50 times the length of a standard 1-meter unit. The length of a corridor in a hospital was found to be 100 meters (M). How many times the standard unit, 1-meter, was the length? _____
M.	4. The roll of gauze has a length of 50 meters (M). The meter is the unit for length. The "M." is an abbreviation used for meter. You will note that it is capitalized. The abbreviation of ten meters could be written 10_____.
unit	5. The smallest quantity in any measurement, expressed as a whole number is a _____.
300 meter	6. A 300-meter tower has _____ units, each unit having a length of one _____.
b	7. Other systems, sometimes known as common systems, have other units for length. These other systems are not identical with the metric system. a. The tower is 1000 feet high. b. The tower is 1000 meters high. Is a or b in the metric system? _____
neither	8. The unit, foot, is not a metric quantity. Neither inch, nor yard, nor mile is a metric unit for length. When other units for length other than meter are used, the system is not metric. a. The car traveled 100 miles. b. The bed sheet measured three yards. Is a or b in the metric system? _____

*Note: Each question is a frame. The answer (left side of page) would appear in the text on the next page.

Table II (Continued)

decimal	9. The *metric system* or *decimal system* was formulated in France in 1799. The standard unit for length is the meter. It is approximately *one-ten-millionth part* of the distance from the earth's equator to the north pole. The metric system is sometimes called the _____ system.
yes	10. The decimal or metric system was formulated in France. It is now a legal standard in this country as well as other countries for comparison of other systems of measures. The meter is now an arbitrary length on a platinum-iridium bar kept near Paris. The metric system is a legal standard in this country. (yes or no) _____
weight	11. The metric system of measures is accepted by scientists throughout the world because of its simplicity. The *meter* is standard unit for length. *Liter* is the standard unit for volume, while *gram* is the standard unit for _____.
volume	12. *Gram* is the standard unit of weight, while *liter* is the standard unit for _____.
a—meter b—gram c—liter	13. In the metric system the unit of a. length is the _____. b. weight is the _____. c. volume is the _____.

Table III
An Example of a Programmed Text Based Upon the Crowder Method Appearing in a TutorText Titled, "The Arithmetic of Computers."*

Lesson 2

The Arithmetic of Powers

In Lesson 1 we learned how powers of numbers are written by using exponents. Exponents, of course, were designed to be more than decorative additions to our number system. They provide us a quick and easy way to multiply by adding, and to divide numbers by subtracting. This is essentially what engineers do when they manipulate a handy little computer called a "slide rule."

If you wanted to multiply one power of a number such as 2^2 by another power of that same number, such as 2^3, you could find the product by expanding the powers and multiplying by ordinary arithmetic. Since $2^2 = 4$ and $2^3 = 8$, then $(2^2)\ (2^3) = (4)\ (8) = 32$. But when you are asked to find the product of two powers of the same number, the product also should be written as a power

*From page 21, *The Arithmetic of Computers*, Crowder, N. A., published by Doubleday & Company, Inc., Garden City, New York, 1960.

Table III (Continued)

of the number. In other words, the answer should be in the form b^n. You will see shortly that this will lead to some interesting results.

Now, in the example $(2^2)\ (2^3) = (4)\ (8) = 32$, we can also write 32 as the power of 3, because $32 = 2^5$. So the entire equation can be written in powers.

$$(2^2)\ (2^3) = 2^5$$

In this case, the product is a power of the same base as the two numbers that were multiplied. If we multiplied powers of 3, say $(3^2)\ (3^3)$, would the product necessarily be some power of 3?

Answer

Yes. page 48

No. page 55

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R. A. LYMAN, JR.*

A PART OF THE PAST

Fortunate are teachers and learners, for they of all people may escape for much of the time from the almost universal preoccupation with the present and the immediate future. The nature of their work insures that they devote much attention to the past, which, after all, constitutes most of reality. The present lacks any duration whatever, for it comes and goes in an instant. It would hardly be worth our attention at all if it did not continually contribute to the past. The future exists only as it is inherent in the past. So only the past is real, and its immensity, like its influence, is without measure and without limit. Teachers are largely creatures of the past. They speak from the past hoping to influence the future.

Much is expected of teachers. They are supposed to generate and to encourage originality and spontaneity in their charges. Nobody knows what these qualities are or where they come from. They are in a way products of the past and yet represent conflict with the past, for they are unique and at variance with all that has come before. Because the teacher hopes to elicit what is new and unpredictable, the relationship between teacher and student is apt to be somewhat strained and awkward—even frustrating—but at the same time most necessary and most worthwhile.

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In this essay I wish to focus attention on only one place where the past has a bearing on education, the laboratory part of courses in science. The basic trouble with laboratories is that they are so often contrived and operated by teachers who do not wish to teach, for students who do not wish to learn. Oddly enough, neither is to blame for these deficiencies. Teachers at the college level are selected from those having greatest capacity for learning and for making known the results of their learning. Being primarily learners themselves, they enjoy the company of other learners and are apt to be impatient with those who are not so inclined. Sometimes I wonder if the college teacher is more than a fiction, because colleges are, or should be, assemblages of learners, the more mature learners serving as guides, as critics, and as examples for the less mature ones. If there is such a thing as a superior teacher, it is only because his greater accomplishments as a learner render him a more competent guide, critic, and example. Learners make the teachers, but I question whether any teacher or any concentration of teachers ever make the learner. The student who is a student in name only and who is not bent on learning is not really to blame, for he is young and full of that magic quality that we are apt to designate as frivolity, a quality which we are disposed to criticize, to deprecate, and to envy. All of this is as it must be if we are

to select scholars as teachers and ordinary young persons as students.

From the standpoint of the learner, the better laboratories in college science courses are those in which time is simply wasted. For youth there is nothing much wrong in the mere wasting of time. Nothing has value that one has in abundance. Young people are surfeited with time, and, when left to their own devices, they find pleasant ways to consume it until they are no longer young. Then, time suddenly becomes valuable and they can put it to good use. Much of the college effort is designed to waste time in organized and deliberate fashion, with direction and with supervision. So, I do not seriously object to laboratories which only waste time. It is those that pervert the student and corrupt his untried and unharmed capacity to learn that I would speak against. Such, I am sorry to say, is the usual kind of laboratory.

The most charitable view that can be taken of the conventional laboratory in a college science course is that it could give the student a real appreciation of the past—the early and middle fourteenth century to be exact. It is fine to develop an understanding of the past, but the student should realize that it is only the distant past and not even the recent past that he is studying. Students in science courses are never given to understand that the laboratory part of the course presents learning and science as they both were in the late middle ages.

During the early fourteenth century the science of anatomy became a respectable branch of learning in European universities instead of an avocation for ghouls, petty criminals, and physicians. As dissection became legitimate, the professor, as successful professors often do today, withdrew from his subject. He ascended his high professional chair and relinquished the scalpel and forceps to a menial, the demonstrator. The professor's understudy or junior colleague, the ostensor, interpreted the professor's directions to the demonstrator. The professor read from a learned work, usually a corruption of Galen which had passed through three translations before coming to his attention. As the professor lectured from the book, the demonstrator disclosed the anatomical features, but naturally, under the watchful eye of the ostensor, he showed only what he was directed to find. The students looked on and saw what they were supposed to see. The professor, twice removed from the cadaver, had lost all contact with his subject, and moreover he wanted none, a preference which is almost understandable if we remember that preservatives for anatomical preparations were unknown at the time. Anatomy under these circumstances was no longer a science, but had become a philosophy, and so it remained until the time of Vesalius. Today, although we ridicule this kind of teaching and this kind of learning, we practice and we endorse it.

Now the professor reads from the work of some modern Galen in the lecture hall. In the laboratory the ostensor, or laboratory assistant, directs the activities of the demonstrators, or students. After six centuries the only real improvement we have managed to initiate in the teaching-learning process is to make the students demonstrators. This is a small gain, for although they hold the scalpel, Galen still directs their movements. They dissect, but they note only what they are told to find. They make observations, but only those that they are supposed to make. They draw, but their drawings must conform to those of Galen, somehow without appearing to. They even perform "experiments," but the experiment must come out in a certain way, i.e., as it did for someone else, long ago and perhaps far

away, when the world was different and experiments came out "right." As a final mark of his utter subservience to the system, the student is generally required to leave his copy of Galen outside the laboratory where it can have no corrupting influence on the spontaneity with which he duplicates the observations and mimics the conclusions of the master. Note how the system favors the security of the professor who is its architect and its defendant. He can stroll confidently through the laboratory with his copy of Galen firmly beneath his arm, or even more securely memorized in his head. He can criticize the perpetrators of the experiment that did not come out right and commend the author of the sketch which duplicates the book, but not too accurately. This, I am convinced, is a true picture of teaching and learning in the science courses of the twentieth century! Is this the way to produce inquiring minds? I think not.

The designers of these farcical laboratories have done their work well. Objects for study have been selected that can be seen in but one way. "Experiments" are chosen with a view to selecting those which always work right. Anything is deleted as soon as it is found in the least unreliable or unpredictable. A "good laboratory" is one which runs along with the precision of a well-rehearsed television script, and the student presumably swallows his dose of learning like a pill and, the smaller the pill and the thicker its saccharine coating, the better it satisfies not only the student but the teacher as well. Somehow, work in the laboratory has come to be an end in itself, irrespective of the ultimate learning that accrues from it. Grades and credit are given for time spent and for effort made, rather than for understanding obtained. The sight of students working in a laboratory is thought to be gratifying to the professor, and, strange to say, it frequently is. The students are in their places, he is in his, and both are fulfilling their manifest destinies as the laws of the universe have presumably ordained from the beginning of time.

What is evil and what is harmful in this peaceful, pseudo-scientific ritual? Only this: by performing stereotyped experiments and making stereotyped observations and writing stereotyped reports, the student is led to believe that all scientific thinking, including *good* scientific thinking, is stereotyped. He is taught to revere the written word, not because he can demonstrate its truth, but because it is written. He comes to look upon science as predicable, infallible, all-knowing, sufficient for all purposes, and applicable to all ends. He is trained to be uncritical, docile, and devoted to conformity. He sees only through the eyes of others. He thinks only in the patterns of thought belonging to others. Worst of all, he is content, for he feels secure in his prison. He is secure. He will "pass the course." He will qualify for the grade, rather than earn it, and he will not ask embarrassing questions.

This is the kind of training that is responsible for the fact that men studied, copied, and lectured from beautifully drawn figures of the circulatory system for 500 years without ever giving any serious thought to how the system worked. For that length of time intelligent, educated men apologized to each other for the fact that they could neither see nor demonstrate in any way the presence of pores communicating between the right and left sides of the heart, but they acknowledged the presence of these openings just the same, because Galen said they were there, although even he himself admitted in a lucid moment that he could not find them either. This is the kind of training that even today is turning out students with degrees in

chemistry who will filter a perfectly clear solution because the directions say "filter." This is the kind of training that turns out a biologist who will prepare a sterile glucose solution by boiling the water, cooling it, and pouring in the sugar from a bottle on the reagent shelf.

What is to be done? How can we break with the tradition of the fourteenth century? How can we enable the student to appreciate the worth of the past without accepting its shackles? How can the ghost of Galen serve, rather than enslave, the coming generation of scientists? I can think of some ways, and no doubt there are others.

First and most important, let us change the whole concept of the laboratory part of a course in science. Much can be done by one simple maneuver, by making the laboratory part of a course a privilege rather than a compulsory task for everyone. Anything can be presented well enough for the casual student from books, lectures, pictures, and films. By "casual student" I mean the fellow who is bent on qualifying rather than learning, who aspires to the "gentleman's C." Those who want more than this must prove in some way that they are deserving of it. The burden of this proof must be on the student rather than on the teacher.

Once established as a privileged portion of the course for the select, the laboratory must be operated differently from the rock pile in a prison. The student must be encouraged to bring his copy of Galen, and other references should be at hand. The laboratory is a place to compare authority with reality, to feel with the fingers, to wonder, to meditate, to question, and to argue. Above all, it is a place to discover that observations can be misleading, that experiments can be inconclusive and, moreover, that both generally are. The consequences of such revelations, I hope, will be to encourage criticism, skepticism, and suspicion of accepted scientific belief. The purpose of a laboratory is not to show that what is known is true, but that it is false. The mind that seeks for truth must first be filled with doubt.

Of course, the conventional cookbooks that now pass for laboratory guides will have to be thrown out or rewritten for such a course. Experiments which do not work reliably must be included so that the student can criticize them, recognize their shortcomings, and learn to design experiments to answer questions. Little can be learned from an experiment that is predictable. It is the unexpected result that jars the mind from the accustomed rut and sets it upon a new course. If we eliminate from science the unpredictable, the inexplicable, the confusing, the frustrating, and the miraculous, we have strained the nourishment out of the soup. There is nothing left but water, old bones, and a few sharks' teeth.

The tradition of Galen has a place in modern teaching and learning, a very real place, but one that needs defining. In the laboratory we should feel a kinship with our predecessors, but not a blind devotion to them. The giants of the past live on in the laboratories of today not because of their work, but because of their methods. Our reverence is not for their findings, but for their way, their vision, and their courage. They saw with their own eyes and not through those of their predecessors, and they dared to speak boldly and clearly of what they had seen. The most difficult task of the scholar of today is exactly what it was two thousand years ago: to see what is actually to be seen rather than what one expects to see and to know when to defy the authority of the past. He must find ways to stand upon the knowledge of the past instead of lying crushed beneath it.

Nothing is sacred in science but freedom of thought. We study the opinion of the past, first to understand it, and then to expand, to modify, to challenge, and to refute it. Such is the goal and purpose of scientific study. In science there are rules only to be questioned, truths only to be doubted. There are no laws governing the universe. The universe is law. Bodies do not fall because of gravitation. A falling body is gravitation. And, incidentally, its falling is a perfectly inexplicable event except in terms of other falling bodies. If one appreciates these principles upon which all science rests, he can safely study the opinions of others and still feel encouraged to have some of his own.

The history of science is not an account of the progressive growth of reliable knowlege which culminated in the dawn of an enlightened scientific age at the beginning of the present century. Rather, it is largely a story of the mistakes, the stupidity, the blindness, and the prejudice of mankind. Our inspiration should come from the realization that the very persons who were guilty of the errors now and then experienced flashes of insight that illumined the way, not always for themselves, but often for someone who followed long after them. Let us look to the past to study the nature of this insight, its cause and its consequence, but let us not ignore what can be learned from the folly, for it is part of our heritage as well. If we claim for ourselves the insight, let us remember that ours also are the mistakes, the blindness, the prejudice, as we and our views, moment by moment, become a part of the past.

RUDOLPH H. BLYTHE*

ADVANCED EDUCATION FOR PHARMACEUTICAL RESEARCH**

The undergraduate curriculum in pharmacy provides an unusually broad scientific background. Therefore, graduates frequently pursue advanced study to prepare for research in pharmacy, pharmaceutical chemistry, and pharmacology. All of these specialties are practiced in both academic and industrial pharmaceutical institutions. However, this paper will deal only with pharmacy, the science and technology of dosage forms. This definition is broad, as it encompasses all factors affecting the acceptability, stability, or efficacy of the drug in any form. Efficacy, in turn, includes all physical-chemical modifications of either the drug or its vehicle which affect the rate or efficiency of absorption, the nature or site of release of the drug in the body, or its rate of metabolism or excretion.

Academic research is directed generally toward the investigation of basic principles whereas industrial research is more often directed toward the goal of product formulation. Therefore the scientist's aims and institutional connection have a bearing upon the courses that he will find most useful. We will sequentially discuss the three factors that the research man most often encounters and will consider the special training needed for each.

Product Acceptability

The research pharmacist must know what qualities are required to make the product acceptable to the particular age group and type of person that might use it, and how these characteristics may be built into the product. This knowledge is extremely important. If the product is not well accepted, the patient will not faithfully follow the physician's directions; therefore he will not obtain the full therapeutic effect from the product. Some applicable knowledge may be gained from courses in psychology, but most must come from practical experience.

Stability

A product must be both chemically and physically stable until it is consumed by the patient. Prescriptions compounded in the retail pharmacy require only short-term stability, generally two or three weeks. However, when highly potent drugs have to be produced in mass quantities, it becomes necessary that they be made in large industrial pharmacies for distribution through wholesale and retail channels. Some must withstand world-wide dis-

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**Presented to the Section on Pharmaceutical and Biochemical Education of the Fifth Pan-American Congress of Pharmacy and Biochemistry, Santiago, Chile, 1960.

tribution. This necessitates a much longer stability. Therefore, one should require that the product maintain a potency equivalent to at least 90 per cent of the label claim for two years following manufacture. Many people consider it desirable to maintain this potency for three to five years.

Research in stability problems is generally carried out differently in academic and industrial organizations. Since academic research, frequently carried on by graduate students, is principle-oriented and aimed primarily at educational purposes, the academic study of stability usually involves the investigation of the exact nature of the breakdown of the medicament and of the factors that affect it. One would usually determine, for example, whether the breakdown is of a hydrolytic, oxidative or free radical mediated nature. This kind of investigation requires a thorough knowledge of both organic and physical chemistry. The investigator must not only know or be able to hypothesize the various potential paths of breakdown, but must also be able to calculate the rate of breakdown. In order to be able to study these reactions, he must also have a good knowledge of analytical chemistry. He must be able to understand and interpret the scientific literature relevant to his particular problems. To equip people for this work, the pharmacy school must have an extremely strong chemistry department or access to such a good staff in other schools on the university campus.

The industrial approach to stability is generally considerably different. A company that has a large stake in a given class of compounds may be interested in fully exploring the nature of a breakdown as well as of the kinetics involved, but, in most cases, the industrial research pharmacist is primarily concerned with the rapid development of a stable, acceptable product. He must balance the factors affecting acceptability against those affecting stability. They do not always go hand in hand. He is less interested in the mechanics of breakdown, other than that which he must know in order to select the proper adjuvants such as buffers and so forth, because it is the industrial research pharmacist's responsibility to produce the best possible products in the shortest possible time. He frequently approaches the problem by designing a rather elaborate experiment along factorial or more likely fractional factorial lines, so that the experiment covers the majority of variables, and sometimes involves several dozen formulas. The experiment is usually designed after a few probing pilot studies have been made to determine the general parameters in which one must work regarding buffer substances and other stabilizers such as antioxidants. Although the research pharmacist is not expected to be an expert statistician, he must have a good working knowledge of many types of experimental design and also know how to calculate the precision and dependability of his results.

Drug Absorption

Drug absorption is the newest and probably the most important single aspect with which the research pharmacist must cope. The importance of drug absorption has become much more widely recognized with the rapid and broad adoption of the use of sustained action medication and, to a lesser extent, of inhalation therapy. It is very easy to realize that the efficacy of a drug is going to be related to the rates and completeness of absorption. It is much more difficult to appreciate the hazards that may be involved with those drugs in which absorption varies from one person to the next or even from one time to the next in the same person.

Consider, for example, the dangers involved when one administers potent quaternary compounds orally and finds as much as fivefold difference in therapeutically effective doses in different individuals.

It is now realized that the pharmacist can serve a very useful purpose and make contributions comparable to the invention of a new medicament simply by designing superior dosage forms. These are usually based on controlled and modified absorption. Although the research pharmacist does not have the same degree of specialized knowledge of the chemistry of drugs within the body as the biochemist, or of the degree and type of action of certain drugs as the pharmacologist, he probably represents the only discipline which is wholly conscious of the potential use of pharmaceutical dosage forms to accomplish desired and, at times, unique therapeutic results.

Again we see a further difference between the demands on the academic and the industrial research worker. A research pharmacist working in an academic institution, where there is less interdisciplinary action than in industry, is unlikely to be investigating drug activity, unless it is his major interest. If it is, he will often acquire the specialized knowledge needed to be a research biologist also. If he is employed in industry, he would need only have a good comprehension of biochemistry and pharmacology. Any industrial company that is interested in investigating a problem dealing with drug utilization will have a large organization including biochemists, pharmacologists, and other scientists, who will work with the research pharmacist on the problem. Therefore it becomes the research pharmacist's responsibility to know what has to be done and have sufficient working appreciation of the biochemistry, pharmacology, physical chemistry and other disciplines to understand what can and cannot be done.

Special Courses

From our discussion of the work so far, we see that the pharmacist must have advanced thorough training in organic and physical chemistry. Since he is not actually going to make compounds, he does not need to be a master of laboratory technics of synthesis, but he does need a thorough knowledge of physical and chemical behaviors. Also, qualitative organic chemistry and electronic interpretations of organic chemistry are useful tools because these help him to recognize the types of reaction that he may encounter in combining various agents, particularly multicomponent ingredients such as flavors. In order to handle the physical-chemical problems of kinetics and the statistical problems, he must have a good grounding in mathematics, preferably through calculus.

We have also seen that it is important that research pharmacists have had sound courses in biochemistry and pharmacology, although these need require only enough laboratory work to give the pharmacist a non-specialist's understanding of the subjects.

We previously indicated that research pharmacists are becoming more and more interested in developing unique dosage forms. These involve such problems as preparing superior emulsions and suspensions, and the creation and use of insoluble or lipoid-soluble therapeutic agents. To solve these problems requires a good knowledge of the surface chemistry aspect of physical chemistry. In some cases it is highly desirable that the physical chemistry be supported by additional work along engineering lines, because the research pharmacist should be adept at scaling up his methods into pilot-size operations.

The research pharmacist cannot be a "jack of all trades" and yet have the desired depth of knowledge in any one. It is very fortunate that most pharmaceutical research is carried on in the larger universities and in moderately large industrial pharmaceutical laboratories, for in these places one technical expert can draw upon the specialized skills of others. A team of experts is able to handle more problems better than any one man could hope to do alone.

Summary

The research pharmacist is generally a man who has had a Bachelor's degree in pharmacy and a graduate degree, preferably a Ph.D., majoring in some specific problem area. It is important that he be grounded in physical and organic chemistry and that he have an appreciation of the biologic sciences and a working knowledge of mathematics. While his course work should be in the basic sciences rather than in manipulative operations, he should be instructed in the practical applications of the theories so as to develop his interest and breadth of thinking.

With the five-year program now in effect at all pharmacy colleges in the United States, it is to be hoped that the man who has selected research for his career will take essential prerequisite courses and perhaps even some of a graduate caliber, during his last undergraduate year, rather than wait until after he has earned his Bachelor's degree.

He would also benefit by getting industrial experience during the summers immediately before and after graduation.

The graduate student should be well trained in the use of technical literature and have developed an ability to scan it with the minimum expenditure of time.

Few areas of research demand such a breadth of academic training as does pharmacy to handle the problems that normally occur.

CHARLES W. BLIVEN*

THE DESIGN AND PURPOSE OF THE TEACHERS' SEMINARS**

While the title of this paper indicates that both the "design" and the "purpose" of the seminars are to be covered, I shall reverse the order. The purpose is of greater importance; the design merely aids in achieving the purpose.

I have often thought that either we are holding a seminar each summer through habit or they are beneficial to those who attend and thus to our educational programs. I am sure the latter is the case.

It is quite appropriate that we should stop on occasion to consider the purpose of the seminars. This is essential. But equally essential is time spent on determining if they are achieving the purpose for which they were originally established. Perhaps the original purpose is no longer the best objective, and, if this is the case, the desired purpose should be determined and the design changed to facilitate reaching the new objective.

As you will recall, at the 1960 seminar time was devoted to the effect of the seminars on undergraduate teaching. At the interim meeting of the Executive Committee (November, 1960) considerable discussion occurred relative to the need for, and the best manner of, evaluating past and/or future seminars to determine if they are achieving their full potential. The consensus was that a permanent committee should be established for this purpose, and to this end Vice President Parks was made chairman of a subcommittee.

The annual seminar of teachers sponsored by the AACP with the financial support of the American Foundation for Pharmaceutical Education is an outgrowth of the Pharmaceutical Survey, 1946-1949. After reviewing the "qualifications and conditions of service of the members of the faculties," Director Elliott wrote as follows:

> It is self-evident that the effectiveness of the education and training for the profession of pharmacy is determined chiefly by those who teach. The evidence is clear. An undue proportion of the existing teaching staffs is lacking in the thorough scientific preparation that is essential if the training for the profession of pharmacy is to be maintained on a level comparable to other professions. Approximately 45 per cent of those of professional rank have only the master's degree or less. Furthermore, there are no available t r a i n e d reserves

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**Presented to the Section of Teachers of Pharmacy, AACP, Chicago, 1961.

> from which to meet the immediate teaching needs due to the greatly enlarged enrollment of students.

Thus, the need for action was clearly established. The subsequent recommendation for the seminars for teachers beginning in 1949 stated:

> The primary purpose of these seminars is that of providing needed opportunity for the members of the teaching staffs, and for graduate students to come into fruitful contact and to keep pace with progressive content and methods of pharmaceutical teaching.

"Fruitful contact," "progressive content," and "methods of pharmaceutical teaching" are the key phrases and, in my opinion, constitute the purpose of our seminars even today. The content has been altered slightly during the past few years in that less emphasis has been devoted to methods of teaching. In the early seminars, particularly the first, considerable time was spent on "how" as well as "what" to teach.

Included in the 1949 seminar were three papers by Milton O. Pella, school of education, University of Wisconsin, titled "Some Fundamental Physiological Principles of Learning," "Methods of Presentation," and "Techniques and Educational Principles." A fourth paper by Dr. John R. Mayor, University of Wisconsin, "Some Suggestions in Teaching Fundamental Mathematical Concepts," was on "how to teach" rather than on course content. These appear in the January, 1950, issue of the *Journal* and are well worth reviewing.

In opening the 1949 seminar, President Bernard V. Christensen stated another purpose of the meetings, namely, "to arrange the subject matter in organized courses in the curriculum to assure a logical presentation in the colleges." The content of the early seminars bears evidence that this was one of the purposes.

Dr. Joseph B. Sprowls in his paper of last summer, "The Effect of the Teachers' Seminar on Undergraduate Training," does not agree that this was one of the purposes. While he stated that the seminars "were not originally intended to serve as discussion forums of the curriculum or its planning," he pointed out that new courses have been adopted as a result of the stimulus of the seminars.

Let us turn now to the 1961 seminar. Is the purpose of this meeting materially different from those objectives stated above? The answer to this is "no." The objectives of the 1961 seminar were set by pharmacy teachers in their response to the questionnaire circulated last fall (1960) by Executive Committee Chairman Hewitt. There were about 160 responses, and your wishes set the pattern for the program.

There was a strong request for information on course content. Accordingly, course content of the four basic courses will be discussed in considerable detail, and you will be given opportunity to express your views and have your questions answered in the workshops, which will constitute an important part of the week's work.

In summary, then, the 1961 seminar has the same objectives as those originally set, namely, to "keep pace with progressive (course) content" and, as President Christensen stated, "to arrange the subject matter in organized courses in the curriculum to assure a logical presentation in the colleges." As in the seminars of the recent past, teaching methods are not being included.

JAMES E. GEARIEN*

THE ROLE OF COURSES IN PHARMACEUTICAL CHEMISTRY IN PREPARING STUDENTS FOR COMMUNITY PHARMACY AND GRADUATE EDUCATION**

The advent of the five-year curriculum in pharmacy will not only necessitate a revision of the courses in pharmacy but will also demand a revaluation of the subject material offered and the teaching methods employed in the courses in pharmaceutical chemistry. Students entering these courses will be, in many cases, at least a year older, will possess a better cultural background, and will be subjected to a less crowded curriculum. Such students, we may hope, will be less vocationally motivated and more willing to accept concepts and ideas which, though not directly related to present-day pharmaceutical practice, will be of immense value to the practitioner in keeping abreast of pharmaceutical research in the future. These students must be presented with a curriculum which will not only challenge them while in college but which will also make them both better citizens and better professional men and women.

Pharmaceutical educators, in establishing the need for the new program in pharmaceutical education, have spoken so eloquently concerning the addition of courses in pharmaceutical administration and the humanities that the teachers of the professional courses may have been lulled into an acceptance of the present standards and goals for their courses and may regard the addition of these new courses as the total goals of the five-year curriculum.

If the five-year program is to succeed, it must produce both a better citizen and a better professional man. It must be remembered by all concerned with professional education that the final responsibility of a professional college is not just to a profession for its own survival, but to the general public dependent upon it for a service. Improvement in this service, made possible by a better educational program, will bring its own reward to the profession.

It will be a tragic error if the five-year program of pharmaceutical education becomes a reality without improving the professional capabilities of our graduates. This improvement must be accomplished through improved programming and improved course content and not necessarily through increased time spent in course work in the professional areas. It is therefore necessary that each section of teachers of the AACP accept the responsibility for re-examining the course content and teaching method in their areas and by

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**Presented to the Section of Teachers of Chemistry, AACP, Chicago, 1961.

mutual discussion and debate seek for continued improvement in instruction. No other organization offers the necessary opportunity for a complete interchange of opinion between professors and administrators. It must be remembered that improved instruction cannot result from legislative action alone, but is achieved by study, discussion, and review by the teachers directly responsible for instruction. The failure of the sections of teachers to assume this responsibility or the abolition of the sections will certainly reduce the opportunity for improved instruction created by the five-year program.

Historically the courses in chemistry have comprised a large and important part of the pharmacy curriculum. It is doubtful, however, if they have usually fulfilled the goals established for them by the teachers of chemistry. Too often pharmacy students have accepted these courses as a required but unrewarding part of their college program. They have seen little use in pharmaceutical practice for the theories and concepts commonly accepted as an essential part of the modern chemistry course. Often the student leaves his college of pharmacy without the ability to utilize intelligently the facts and theories of chemistry in the practice of his profession. This inability of our students to attain the goals established for them by their teachers demands a continuing review of our curriculum and teaching methods. It does not necessarily indicate that our goals are too lofty or are impractical, or that our subject matter is unsuitable for the student of pharmacy.

The inability of the student to utilize chemistry properly in his professional practice is probably a condemnation of our four-year curriculum in which professional courses were taught concurrently with basic sciences. The situation, however, will not necessarily be corrected automatically by the new curriculum. The only practical answer will require the application of basic chemical principles in the solution of pharmaceutical problems by both the teacher of chemistry and the teacher of pharmacy. While it may be assumed that the greatest part of this burden must be borne by the latter, the former is not freed of his responsibility. Actually it is the chemist who can best foresee and teach the applications of his science.

If the pharmacy student is to make use of chemistry, he must learn to use chemical formulas intelligently in solving problems arising in his practice. In his schooling the student has often regarded the formula as an exercise in memory to be forgotten after the final examination. He has failed to realize that it is a key to solubility, chemical reactivity, prescription incompatibilities, stability, and pharmacological activity. Even if he has such a realization, too often he lacks sufficient confidence to utilize such information in his practice.

This is in direct contrast to the graduate who has received the degree of Bachelor of Science in Chemistry. The "average student" who has received this degree has learned to think chemically and to utilize chemical facts and theories. The difference is puzzling when one realizes that, for the most part, the pharmacy student and the chemistry student have taken the same basic courses in chemistry. One can hardly feel that the chemist has a "God-given" talent from which the pharmacist is excluded. The difference must reside in other courses taken by the chemist. Many chemists acknowledge qualitative organic analysis as the course that contributed most to their ability to understand and utilize organic chemistry. This occurs despite the fact that most courses in this subject offer little, if any, new material. Their teaching value exists chiefly in the opportunity to create a situation whereby a student must utilize

his basic knowledge for the solution of chemical problems. This type of teaching must be employed in the courses in pharmaceutical chemistry.

For the past several years, I have used the functional group analysis approach for the course in drug analysis. The presentation of general functional group methods, illustrated by *USP* and *NF* assays, has permitted a different type of questioning on examinations. Students are not required to memorize individual assays but only general procedures. They are then expected to suggest assays for pharmaceutically important compounds and mixtures whose formulas are furnished to them. This requires the student to utilize chemical formulas to predict solubility and chemical reactivity.

Such teaching need not be limited to the courses in drug assaying. Other courses in medical and pharmaceutical chemistry offer similar opportunities. No longer can structure-activity relationships be taught by only measuring the distance between certain functional groups. Stereochemical relationships, conformations, and the polarity of molecules must also be considered. This requires utilization of the theoretical principles taught in the course in basic organic chemistry. A consideration of chemical reactions affecting stability should also be included. The introduction of detoxification mechanisms and antimetabolities includes material from the biochemistry courses. Such concepts must not only be included in lecture material, but the student must be forced to utilize such information in his homework. It is possibly true that teachers of the applied courses do not require sufficient homework to force the student to utilize fully his basic knowledge. The introduction of additional homework will free lecture and classroom time. Such homework must require the utilization of basic chemistry. Lecture time should be used to present new concepts and ideas and not to review previously presented principles. The constant review in classroom time of basic principles reduces the student's need to retain basic knowledge. Furthermore, it fails to contribute to proper reference habits. The pharmacist should be trained to consult not only reference books in pharmacy but also books in the related sciences. This must be ingrained in the student before graduation if he is expected properly to utilize reference works in practice.

The problem of utilizing knowledge is probably more pertinent to the student entering community pharmacy than it is to the student planning to enter a graduate college. The latter has usually been recognized by an interested professor for his ability to retain and utilize fundamental knowledge and, therefore, does not need constant drill in this area. There is need for a program for him that departs from the routine and offers opportunity for acceleration and education in depth. Two years ago the University of Illinois embarked upon a program for exceptional students in which the most qualified were placed either in special sections or in special courses. This has offered an opportunity to challenge students with unusual ability without penalizing the average student. Such a program with the opportunity for advanced elective courses in the area of his choice cannot help better preparing the more capable students for graduate education.

While it is tempting to advocate the establishment of a large number of elective pharmaceutical chemistry courses which are designed to prepare the pharmacy student better for a graduate education, one must realize that the real deficiency in his undergraduate program is in mathematics and physical chemistry, and that this deficiency must be remedied before electing further

courses in applied chemistry. Every teacher of pharmaceutical chemistry must, if he is to prepare students properly for graduate education, counsel his students to elect additional courses in mathematics and physical chemistry.

Undoubtedly teachers of pharmaceutical chemistry will want to play a part in readying pharmacy students for graduate college. They will also be concerned that our excellent students, while registering for advanced courses in other departments, will be encouraged to look elsewhere for their graduate studies. Actually the loss of a few students to other departments and colleges should not be of great concern. Such students performing brilliantly in other fields will be a credit to their original profession and to their undergraduate college. The establishment of a senior research or independent research project, on the other hand, will keep the pharmacy student interested in his own department and college and instill in him an enthusiasm for research in pharmaceutical chemistry.

A senior research or independent study program, if it is to be sucessful, must be limited to the few students capable of entering the graduate college. Such limitation will ensure sufficient faculty time for superior students and eliminate weaker students who need the increased drill of classroom work. Under no circumstance should the program become an easy "B" or "A," nor should students be allowed to elect the course repeatedly instead of completing the much needed courses in mathematics and physical chemistry.

The problems teachers of pharmaceutical chemistry face in preparing students for community pharmacy and for graduate education are not identical, and the two goals are not compatible in an inflexible curriculum unless advanced mathematics and physical chemistry are to be required of all students. Since the present five-year program does not include these subjects, sufficient elective time must be available for highly qualified students to include them in their undergraduate program. This may require a reduction in the number of courses in the humanities and pharmacy administration that can be required of these students. This is a small price to pay to prepare superior students for research and teaching. While they too will benefit from the humanities and should elect such courses when possible, they will continue to work in the cultural atmosphere of a university for an additional number of years and can take advantage of the lectures and concerts available to university students. In my experience, I have found few graduate students who were "laboratory hermits" and who failed to avail themselves of cultural offerings. Instead, the potential graduate student is more capable of self education than is his less talented classmate and will with little encouragement avail himself of knowledge outside his field of specialization.

While many excellent students are not desirous of further education and will practice as community pharmacists, most pharmacy students entering community pharmacy may probably be classed as average students academically. These people will satisfactorily complete their basic science courses, but will need additional drill and training if they are to be capable of utilizing scientific information in their future practice. This must be one of the major goals of the teachers of pharmaceutical chemistry.

GILBERT J. HITE*

SHOULD CALCULUS AND PHYSICAL CHEMISTRY BE REQUIRED OF ALL UNDERGRADUATES?**

The question as to whether calculus and physical chemistry should be required of all undergraduates deserves a "yes" or "no" answer. This is not merely a question of including two new courses in the curriculum. It is a problem which is basic to the foundations and aspirations of pharmacy.

Centuries ago, pharmacy was a clandestine art which, from the Renaissance to the Industrial Revolution, to the atomic era, has become more and more dependent upon the same basic sciences that have lifted the entire medical fraternity to the heights of accomplishment all now enjoy. Pharmacy has emerged as an art and a science or as an applied science wherein empirical knowledge and methodology have been largely replaced by the scientific principles upon which the functions of contemporary pharmacy depend. This is the justification for maintaining that pharmacy is among the ranks of the professions.

Man's innate devotion to and unrelenting search for truth is mirrored in the evolution of all applied sciences which have gradually shifted emphasis from the empirical to the more fundamental aspects of the relevant sciences. Students were thus able to apply scientific principles to an array of seemingly unrelated problems. It is the goal of every educational system to encourage independent thought—to stimulate creative activity. This is how the future of a profession ought to be molded. This is how to mold the future of a profession if it is to sustain itself and grow.

How far ought the scientific physical-chemical approach be carried into our pharmacy dispensing courses, our medicinal products courses, our biochemistry courses, our analytical courses? Most of you have already made the choice for pharmacy as evidenced by the discussion in every college of pharmacy of buffers; colloids; emulsions; suspensions; solubility; colligative properties of solutions; rate constants of drug deterioration, radioactive decay and biochemical reactions; equilibrium constants of complex formation and biochemical reactions; and thermodynamics, to mention only a few of the more prominent topics.

The nature and complexity of much of the material in the *USP XVI* and *NF XI*, material of which our students must have more than a passing acquaintance, emphasize the importance of the physical-chemical approach and justify its adoption and continued exploitation as the means of imparting a thorough understanding and an enduring working knowledge of these and analogous drugs now being marketed.

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**Presented to the Section of Teachers of Chemistry, AACP, Chicago, 1961.

Any conclusions regarding either the establishment of calculus and physical chemistry courses in our curricula or the rigor with which the physical-chemical approach is to be applied should be predicated upon and realistically geared to the objectives of pharmacy as it evolves to meet present and future challenges. Perhaps each of you will be able to answer the question to your own satisfaction after considering these remarks and after reflecting upon the training afforded graduates of your respective schools.

It seems that we all recognize the importance of the physical-chemical approach to pharmacy and the related courses mentioned earlier, for we are already presenting various elements of physical chemistry in any and every course in which pertinent aspects seemingly help to place the subject matter in a more logical light. Some educators even point pridefully to this as a sign of progress. Invariably the students do take a prerequisite course in physics. But, all too often, our curricula stop there. Why do some pharmaceutical educators resist the implementation of a course in physical chemistry, a well-established, formalized, fundamental science, deserving a logical place in the sequence of basic science courses, the content of which is so often drawn upon by the applied science of pharmacy? The claim that physical chemistry is rightly in the domain of education of graduate students is erroneous. The complaint often heard is: "What are you trying to do, make graduate students out of them?" Physical chemistry can be handled on the undergraduate level. It is being done—even in some of our schools of pharmacy today. Need we treat the course any differently from those given to chemistry majors? After all, the expanded pharmacy curriculum bespeaks of some graduate stature. Since when do we have to apologize for insisting upon excellence if a need for such a course for undergraduate pharmacists can be demonstrated to be in the interest of sound pedagogy and pharmaceutical practice? Those who discount physical chemistry do not realize that they are requiring far more of an undergraduate than of a graduate student when they present fundamentals and applications at the same time and expect the students to be able to master the fundamentals and to apply them in pertinent situations. At least a graduate student has had two semesters of physical chemistry before he is expected to do this. Obviously, the students do not master the fundamentals and usually cannot apply them except to exactly those problems presented in class. In most instances, these problems are not paragons of practicality. The students have in fact learned a rule—not a principle.

Thus, time from dispensing courses, for example, should not be devoted to teaching both fundamental concepts and applications at the same time. The result is invariably a sacrifice of sound basic understanding in the science area involved and a weakening of the fibre of the professional training. This is not a sign of progress. It is going from empiricism back to empiricism of a more confounding nature to the student who lacks the theoretical and practical command and who wonders—"What formula do I use now?"—not "What basic principles and parameters must be considered in this situation and how are they related?" Mere exposure to this material is not adequate training to provide the student with even an intelligent grasp of a science upon which his profession is dependent. This method of presentation defeats the very thing it sets out to accomplish, for, if material is worth presenting, it merits presentation in such a way as to ensure its continued application. This requires a

thorough understanding and command of the principles of the subject and not merely the memorization of a set of rules to be applied in seemingly remote situations.

Where theory and applications of any subject matter are considered so important as to warrant their widespread presentation, and where both are handled in a single course, time limitations, if nothing else, militate against presentation of the subjects on an intellectual level or on a practical level conducive to stimulating and orienting the potential graduate students and high calibre community pharmacists. Such practices are not a reflection on the teacher but on the system. Pedagogically, and for practical reasons, too, it seems more sound to provide for physical chemistry and physical pharmacy, for instance, in separate courses in that order.

Many educators feel that the application of physical chemistry, usually referred to as physical pharmacy, is "adequately" included in pharmacy technology or pharmacy dispensing courses. I do not presume to imply that approaches other than that outlined here are totally inadequate. Things of this type are never all good or all bad. They depend largely upon the program of the school and the faculty involved and can conceivably be as effective. But, what is "adequate"?

It is my impression that the theoretical and applied quantification of pharmaceutical systems and phenomena according to the laws of mathematics, physics, and chemistry should be provided for in a unified course sequence including a course in physical chemistry.

The ultimate reason for teaching any such courses in the curriculum as prerequisites for other courses is that they better prepare pharmacists to serve in some distinctive, essential, professional capacity, advisory or technical. But is there a need in the practice of community pharmacy for the services which courses in calculus and physical chemistry would augment? I believe there is for the creative capacity of a professional should not be subjugated to the other business or professional services required of him.

In spite of the large number of proprietary preparations, pharmacists engaged in hospital practice and retail practice often can, but few do, contribute to the flexibility of many of the therapeutic regimens practitioners feel justified in prescribing for their patients. A sound approach to formulating in collaboration with the practitioner, a practice all too seldom pursued in retail pharmacy, is achievable only through the application in dispensing courses of chemistry, pharmacology, and physical chemistry. In particular, ointments, emulsions, ophthalmic solutions, oral solutions, and suspensions have proved to be a fertile field offering challenge, personal satisfaction, and a more lucrative practice, while closer association with the practitioner invariably helps to assert the professionalism of pharmacists. If the practice is not more prevalent, the blame lies with the institutions which fail to recognize that retail pharmacists want more than a technological background. They want the scientific understanding which will help lift the profession out of the boredom of the proprietary back room, the sanctity of which most new graduates feel reluctant to leave in favor of the front store. This attitude is quite probably born of the continual barrage of professional status symbols and propaganda to which the students are exposed from their first to last year of college. An ideal vision of what pharmacy should be grows within these students and becomes more fervent with each passing year only to be squelched after graduation or when practical contact is

made with something far less noble than they had imagined. The inadequacies of their education are usually forgotten or at least accommodated by other duties which fill the growing void developing as a result of disuse of what training they have received. It is an insidious process. Rarely is it noted until it is too late.

The reason for this is most apparent to those who have worked as registered pharmacists. Briefly, after registration the new pharmacist is impressed, and justly so, by his new-found status and by his useful contribution. However, the challenge, once accepted, soon ceases to stimulate and the drudgery of counting and labeling takes its toll. The creative pharmacist would, and does, look for new challenge and conjures up new professional opportunities. But do current curricula really provide the educational background to encourage effectively this admittedly vital creative role? Ample indication that they do not is the minor extent to which retail pharmacists extend themselves in this direction in spite of the fact that such functions are professionally and financially sound investments of education and capital respectively.

Congratulations to those who "recognize" that organic chemistry and physical chemistry, even physical pharmacy, are not paramount in today's practice of retail pharmacy. But is this the future we would hold out to pharmacy? The pharmaceutical industry, in the past ten years, has seen the most rapid rate of growth and scientific progress of any industry with the possible exception of the missiles industry. If retail pharmacy has not progressed along these lines of scientific development, if pharmacies have been relegated to the role of distribution depots, if pharmacists have been relegated to the role of purveyors, then somewhere the educators and the educations of pharmacists are wanting.

It is currently popular to see the slogan, "Today, more than ever before, the wonder drugs require the professional skill of your pharmacist." Why? There are many good old-timers who have no degree and somewhat less schooling than today's youngsters. I submit that the former are doing just as good a job as the latter, who, in spite of their more scientifically oriented educations, still enter the back rooms of pharmacies a bit awed by it all—even a bit frightened by it all.

The number of compounded prescriptions has been decreasing for many years until today their number is vanishingly small. Isn't it interesting to note that the number of compounded prescriptions has decreased while the level of scientific education of pharmacists has increased? Obviously the picture is not that bleak. More is demanded of today's medicinals and those who handle them—the science of medicine and related sciences have left their mark and will continue to demand more of those who would serve its cause. Pharmacists have had their hands in the evolution of contemporary medicine and medicinals. Their contributions in industry have helped to advance the level of health care in this country beyond that of any other nation. Surely this is representative of professional pharmacy.

Is it enough to justify the professionalism of today's retail pharmacist by pointing to his academic prerequisites and implying, because his education compares favorably in scope with the educations afforded related professionals, that here we have a professional? Is he also a professional pharmacist who, having had this education, never uses it or imperfectly comprehends his potential and how to make use of it on the retail level?

The slogan is overzealous and is as meaningless in its implication of the scientific professionalism of today's re-

tail pharmacists by association with the modern "wonders" of drugs as is guilt by association. The goal is commendable How many has it lulled into complacency? Have our students achieved this coveted professionalism? Are our curricula geared to keep pace?

Invariably, the only contact retail pharmacists have with these drugs is dispensing them. Even the ancient art emerging as today's applied science of compounding has largely been usurped by industry, to say nothing of the waning of the advisory function, which is being taken over by highly competent industrial representatives with pharmacy degrees. Only through a vigorous program of selective education can we help recapture the initiative for the pharmacist—the drama, the excitement, and the satisfaction derivable from the art or applied science of compounding which rightfully belongs to none other than him. It is incumbent upon educators to prevent the further divorce of any of the vital, creative professional functions from the practitioner if retail pharmacy is to be kept from stagnation.

The articulate arguments pointing to the economic expediency of mass production of standard dosage forms, albeit under attack in the past, are not going to be reversed, nor should they be. The quadruple nature of pharmacy as a business, a profession, an art, and a science will not suffer from emphasis upon more scientific and professional activity. Is the "professional" pharmacy any the less a business than the catch-all drug store? The public will not suffer financially or from curtailed services by the extension of the professional pharmacy idea. On the contrary, where pharmacists can concentrate on drugs, sick room supplies and other medical supplies, it is obvious that both the public and the profession can only benefit. If upgrading the curriculum in this or any other way results in proportionally fewer pharmacists, then this in itself is an argument for the changes. It is widely stated in defense of today's catch-all drug store that there are two reasons for the retention and expansion of inventories of nonprofessional merchandise. One, to accommodate the consumer; two, *to subsidize the professional.* Somewhere, the third, the pure profit motive, gets lost.

In current curricula which do not provide physical chemistry, the graduate has enough information to be familiar; usually, though not invariably, enough to counsel intelligently; and rarely enough to create. There are innumerable opportunities for pharmacists to serve in a creative or advisory capacity in urban or rural areas, in hospital or private pharmacies. These are not isolated opportunities. The field is hungry for confident, competent, ambitious pharmacists, who will make contact with ophthalmologists, general practitioners, dermatologists, dentists, etc., and ask them what they can do for them and their patients to tailor their medication better to their needs—pharmacists who will furthermore show what they can do to achieve these ends for them and their patients.

The *raison d'etre* of each of us, regardless of his departmental affiliation, is to feed into the advanced pharmacy dispensing courses the best qualified, best scientifically grounded students we can produce. The intent of this remark is not to subvert or depreciate any facet of pharmaceutical education, but is rather meant to foster a more effective program. It takes into account that pharmacy is an applied science, that is, an art which today is profoundly rooted in the prerequisite sciences of chemistry and physics and thus, by definition, is charged mainly with the unification and integration, not with the introduction, of such elements into the education of the

finished product—a professional pharmacist.

If it appears that I have deviated from the topic of this discussion by including remarks on pharmacy, the reason is that I cannot visualize pharmacy as a distinct entity apart from physical chemistry. Furthermore, an attempt to give perspective which would point up the advantages of a projected course in physical chemistry for pharmacy students is attempted by placing it in what many feel is an acceptable sequential arrangement. Thus, physical chemistry is applied within the pharmacy sequence. I do not contend that the inclusion of physical chemistry in the curriculum is a panacea, but it is a step in the right direction. It can be a point of strength.

Currently, graduate students from many colleges of pharmacy are doubly burdened by having to take a watered-down, abridged, selective, or applied course in physical chemistry and a second course in graduate school. I submit that these practices are both unsound and inequitable.

There is general agreement that calculus is needed, if at all, as a prerequisite for physical chemistry, or as a preparative course for students going into graduate work where such a course is indispensable and mandatory. My own experience, and I am sure the experiences of many of you, with physical chemistry has led me to the conclusion that calculus is a key to the fullest appreciation, not so much of the mathematical manipulations involved, but rather of the reasons for the manipulations. This having been mastered, the derivation of formulae from simple mathematical relationships is instructive, stimulating, and assuring. Then, and only then, are the relationships of the parameters crystal clear; and then, and only then, can practice on assigned problems place the theories enduringly within the working field of the pharmacist. Sufficient calculus for a two-semester course in physical chemistry can, I know, be included in a two-semester sequence containing college algebra, trigonometry, and calculus. The course would lend a continuity to mathematics not now obtainable. Since no other calculus is required in pharmacy, even of students planning to enter graduate work, there is virtually no wasteful repetition when the graduate takes the full integral and differential calculus sequence in graduate school or as an elective while still an undergraduate.

The second semester of the physical chemistry sequence would be concurrent with the pharmacy preparations course, which would then lead to pharmacy technology, physical pharmacy and dispensing pharmacy. This is the same outline suggested in *The Pharmaceutical Curriculum* by Blauch and Webster, with the exception that the physical chemistry course here suggested is a two-semester sequence.

JOHN M. CROSS*

SHOULD CALCULUS AND PHYSICAL CHEMISTRY BE REQUIRED IN THE UNDERGRADUATE PHARMACY CURRICULUM?**

This question has been asked in a discussion on whether or not the undergraduate curriculum in pharmacy equips the student properly for graduate work and for community pharmacy. The answer I would give is that calculus should be required, but that physical chemistry should not be required in the undergraduate curriculum.

First, in regard to calculus, we find that the main lack in our graduate students is in mathematics rather than in chemistry. To put it another way, a deficiency in chemistry is more easily overcome in graduate school than is a deficiency in mathematics. A student with a poor mathematical background must go back to the freshman or sophomore year for calculus before he can be accepted in a course in physical chemistry. Since many schools require physical chemistry in graduate work, this means that the student (with his bachelor's degree) is not qualified to enter graduate work at many institutions.

It would seem to me that most physical scientists find that the limit on their understanding of their field is regulated by their understanding of mathematics. Once the physical scientist has passed his understanding of mathematics, he must proceed on faith rather than on understanding.

It is not possible for all pharmacy students to have a complete understanding of mathematics, but they could, at least, start their work with a background in the standard courses in differential and integral calculus.

At Rutgers pharmacy undergraduates may take a semester of college mathematics and a semester of differential calculus, or they may elect a full year of calculus. About half elect the former and half the latter course. We have not had a decimation in the ranks of our students, and it would seem that strengthening of the undergraduate curriculum in mathematics is practicable for all students no matter what their future plans may be.

Second, with respect to physical chemistry, we would prefer not to require this course of all undergraduate students for several reasons. One is that physical chemistry is generally applicable to the graduate program and usually carries graduate credit. The student, then, is not making up a deficiency but proceeding with his graduate work when he enrolls in this course. A second reason is that the undergraduate courses

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**Presented to the Section of Teachers of Chemistry, AACP, Chicago, 1961.

in physical pharmacy include the basic principles of physical chemistry. While graduate studies should include the standard physical chemistry course, these undergraduate courses in physical pharmacy probably are sufficient for those students who enter community pharmacy, and the elimination of the course in physical chemistry is no great drawback for those who go into graduate work. A third reason is that one of the original purposes of the five-year program was to increase the breadth of study in the curriculum. While mathematics can be considered a basic arts and sciences course and a "cultural" course, physical chemistry is a much more specific area, and the student can afford to defer this course until after the bachelor's program is completed.

This writer believes pharmaceutical educators should look to strengthening the curriculum in areas already covered rather than to instituting new courses. He also believes that mathematics is one of the weak spots in our curricula. He would therefore suggest that a six-credit course in the fundamentals of differential and integral calculus be required in the undergraduate curriculum, and that physical chemistry and more specific courses in chemistry be postponed until and if the student elects to do graduate work in the field.

PIERRE F. SMITH*

WHAT BASIC COURSE OFFERINGS SHOULD BE REQUIRED IN PHARMACEUTICAL CHEMISTRY AND HOW CAN THESE COURSES BE STRENGTHENED?**

The situation of American university education today is extremely complex and incongruous. The supposedly educated passengers of the Madison Avenue bandwagon have frantically sought the destruction of the "ivory tower." Too often the teacher-researcher of today's university must approach the appalling characteristics of a gregarious idiot in order to carry out the frustrating assignment of being all things to all people. He must be an outstanding scholar, teacher, researcher, administrator, professional man, public relations man, community leader, family man, etc., etc. We in pharmaceutical education have not been completely immune from these pernicious influences. However, we have been sufficiently alert to our prime obligation to strive for better curricula, courses, and teaching methods as evidenced by the Association's teachers' seminars.

The foregoing comments may seem to bear little relation to the subject of this paper, but they will be justified in the latter part under the topic of strengthening courses.

The first part of the assigned subject is the consideration of what basic course offerings should be required in pharmaceutical chemistry. Before attempting an enumeration of such courses, one should consider the two main objectives of professional courses in a pharmacy curriculum. For the sake of the discussion, let us assume that these courses should adequately prepare students for the proper licensed practice of the profession or for future graduate work. It is in the actual specific courses and their scope that a burning conflict may arise in attempting to meet both objectives. Criticism may well be leveled at any curriculum or course which is aimed solely at one or the other of these two objectives. Despite the numerous arguments, pro and con, which can be marshalled concerning each objective, it is academically sound that the quality of courses should be high enough to satisfy potential graduate students. If the scope is not great enough in a particular curriculum or course for these people, then sufficient electives should be made available. I am aware of the pronounced and understandable desires to increase the scientific and professional offerings in the present five-year curriculum, but any marked increases in those required offerings violates one of the main arguments used to establish

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**Presented to the Section of Teachers of Chemistry, AACP, Chicago, 1961.

the five-year curriculum: "students will have a greater selection of subjects in the liberal arts and humanities, subjects so necessary for a truly broad education." Lest my readers think that I am gainsaying modern science and modern professional applications, let me suggest that a good deal of the profound advances in our own specialty, pharmaceutical chemistry, can usually be incorporated within the existing allocation of required semester credits in most curricula today. Frequently challenges arise in the organization of a particular course. But a meaningful integration can be achieved intradepartmentally and interdepartmentally within the college of pharmacy and also within the whole university. As an isolated example, a course in organic pharmaceutical chemistry should (as an applied science) be carefully integrated with pharmacy, pharmacology, pharmacognosy, biochemistry, and organic chemistry. Numerous other examples suggest themselves. Minor duplication of information is excusable; major duplication is indefensible.

What basic pharmaceutical chemistry courses should be required? I am hesitant to call pharmaceutical chemistry basic. Granted, it can and does develop basic principles, but mainly in achieving its professional role of an applied science. Flattering or unflattering as it may seem, we bear the same relationship to chemists that engineers bear to physicists. This restricted concept of pharmaceutical chemistry does assume the undergraduate's successful completion of a strong chemistry sequence: general chemistry, qualitative analysis, organic chemistry, quantitative analysis, and biochemistry. Before listing specific required courses in our specialty, I would like to gainsay the "slanting" of true basic chemistry courses towards pharmacy students. Such slanting may be represented by a well-intentioned modification of course content or, what is more reprehensible, by the lowering of standards of student performance specifically for pharmacy students.

The required pharmaceutical chemistry courses presented here represent, essentially, what will be effected in our own school next year. Again potential graduate students will be able to incorporate their special scientific or professional course requirements into a fairly generous allotment of elective credits (*ca.* 15-18 semester credits).

Recommended are these required pharmaceutical chemistry courses:

> *General Pharmaceutical Chemistry,* two credits of lecture in the second semester of the third year.
> *Organic Pharmaceuticals,* three credits of lecture in each of two semesters of the fourth year.
> *Drug Assay,* two credits of lecture and two credits of laboratory in the second semester of the fourth year.

Before a further description of these individual courses, it should be mentioned that the author would have been happier with three credits in general pharmaceutical chemistry and three lecture credits (in addition to the two laboratory credits) in drug assay. Some minute solace may be found in Henry Clay's dignifying of compromise. One will note the apparent omission of inorganic pharmaceutical chemistry. The subject matter has not been overlooked. Nor in truth has other important material. The elective course, physical aspects of medicinal chemistry, proposed by Martin and Chertkoff (1), contains a wealth of topics, very many of which should be in a required course, general pharmaceutical chemistry, taken before organic pharmaceuticals and pharma-

cology. This mandatory course is designed to prepare students for a study of drug action in much the same way that physical pharmacy serves subjects. Assurances were given that integration between general pharmaceutical chemistry and physical pharmacy could be easily achieved. Obviously a more advanced supplementary elective course can be offered to potential graduate students. With the above thoughts in mind one can appreciate the intent of this required course from its description, "A study of (1) physical properties and chemical structures, (2) physical properties and biological activity, and (3) inorganic compounds of pharmaceutical and medicinal importance including radioisotopes."

Drug assay and organic pharmaceutical chemistry are *sine qua non* for all undergraduates. One need not belabor their justification here. Further details of required individual courses may be found under the second part of this paper dealing with the improvement of these courses.

Even though physical chemistry has not been considered here, admittedly powerful arguments can be marshalled for its inclusion as a required course. Certainly, in a six-year curriculum it would become an academic must. For the nonce, an arbitrary inclusion of six to ten credits of a true physical chemistry course would entail a jeopardizing of the aims of the five-year curriculum. A less intensive physical chemistry course would be of less utility to a future graduate student. Other required courses can be suggested, but they can be offered as electives.

The strengthening of courses can evoke a fine academic Donnybrook. A healthy portion of the Association's teachers' seminars has been devoted to improvement of course contents, associated laboratory courses, methods of teaching, methods of testing, and course integration. These topics are somewhat specific, and similarly there are specific comments relative to those pharmaceutical chemical subjects which I have suggested as required.

The suggested course of general pharmaceutical chemistry amounts to a revamping and strengthening of inorganic pharmaceutical chemistry with what is hoped to be an increase in student interest. Such objectives could be more effectively carried out in a three-credit course.

Drug assay is a course which can challenge the imagination and ingenuity of the instructor. A significant amount of the traditional inorganic pharmaceutical chemistry and qualitative inorganic chemistry can be integrated into lecture and laboratory work. In view of the students' having passed organic chemistry and quantitative analysis, a very significant part of drug assay can be based upon functional group analysis and organic qualitative analysis. There is little excuse for repetition of the traditional experiments of quantitative analysis. Laboratory experiments take on a refreshing and intriguing aspect to instructor and students when modern instrumentation is utilized by the students wherever possible, e.g., automatic balances, pH meters, spectrophotometers, refractometers, and polarimeters. A sobering thought is that the heady (and expensive) atmosphere of instrumental analyses must not obfuscate fundamental principles in a dazzling, light-studded setting of black box magic.

Other suggestions to strengthen courses are not peculiar to pharmaceutical chemistry alone and may be classed as general. The beginning portion of this paper contained a thinly veiled, harsh indictment of the modern American university system. Traditionally, researchers and teachers have looked upon a college or university as a citadel

for true scholarly work. There is no shame to be attached to a desire for a temporary sanctuary from the hypertensive demands of a bewildered society, an apprehensive profession, and overemphasized public relations. The ivory tower is synonymous with an atmosphere of philosophical contemplation. Destroy that tower, and you have removed the most potent factor for the improving of courses, the carrying out of real research, and the earning of the mental wage of genuine accomplishment. All other corrective devices become mere temporary expedients, no more lasting than castles of sand.

Reference

(1) Martin, A. N. and Chertkoff, M. J., *Proceedings, Teachers' Seminar in Pharmaceutical Chemistry*, 1958, p. 103.

MICHAEL IANNARONE*

TEXTBOOKS IN BACTERIOLOGY**

Virtually all phases of courses in the biological sciences taught at colleges of pharmacy have received considerable attention over the years in this section. It is quite obvious, however, that up to now microbiology and public health have received too little attention. The programs of the teachers' seminars on biological sciences and those on pharmaceutical education in general have not specifically included this area to the extent it deserves. Thus, I was gratified to be invited to present information concerning the availability of textbooks for bacteriology courses that are taught in colleges of pharmacy. This provides us with an opportunity to meet and to discuss our views on teaching and to plan for the possible inclusion of bacteriology in future meetings of this section and the teachers' seminars. It would certainly be beneficial to exchange ideas on what our problems may be and how to approach their solution. We may have differences of opinion as to procedures and methods which will help us attain our desired objectives, but I doubt very much that we will disagree very violently on principles.

This paper is concerned with the availability of microbiology textbooks for the teaching of microbiology to pharmacy students. In choosing the title "bacteriology" it is realized that we have given ourselves a very broad canvas upon which to work. Perhaps we can better describe the contents of this presentation by introducing the title "pharmaceutical microbiology." Microbiology courses designed especially for students of pharmacy should be specifically designated and listed in the pharmacy curriculum as "pharmaceutical microbiology." (1)

A fact worth mentioning is that "pharmaceutical microbiology" might imply to others in the biological sciences, not teaching at a college of pharmacy, a substandard or diluted course. This is a misconception, and each of us should do his part to see that the meaning of the term "pharmaceutical microbiology" is understood.

A questionnaire mailed to some of the publishers of textbooks of microbiology was one of the methods used to obtain information for this report. Results indicated that a majority of publishers contacted are not fully aware of the need for a textbook designed specifically for the teaching of undergraduate "pharmaceutical microbiology." Most of the publishers feel that their texts are quite adequate for undergraduate instruction in microbiology. While it is true that the basic techniques and information can be obtained from a number of texts now available, the addi-

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**Presented to the Section of Teachers of Biological Sciences, AACP, Chicago, 1961.

tional, specific, and supplemental information which we desire *i.e.*, biological products, anti-infectives, and antibiotics used in the practice of pharmacy, has not been adequately treated in most texts. However, textbooks in microbiology are now available which have been designed for other professional areas such as nursing, dentistry, and medicine. Why not pharmacy?

The following form was mailed to a number of publishers:

"I would appreciate receiving from you or some one at ..... information concerning the textbooks of microbiology published by ..... that are now being used at colleges of pharmacy as required undergraduate classroom texts."

Results of Questionnaire:

Frobisher, *Fundamentals of Microbiology*, Sixth Edition, W. B. Saunders Co., Philadelphia. Presently used at five (5) colleges of pharmacy.

Burrows, *Microbiology*, Seventeenth Edition, W. B. Saunders Co., Philadelphia. Presently known in use at one (1) college of pharmacy, but publisher is sure more schools are using text.

Four (4) publishers mailed to me a list of microbiology texts but no mention of schools adopting the text.

1. Holt, Rinehart and Winston, New York
2. Appleton-Century Crofts, New York
3. McGraw-Hill, New York
4. Harper Brothers, New York

C. V. Mosby does not publish a book designed for use at colleges of pharmacy, but lists four texts in their catalog that could be used.

These results served as a springboard sending me in search of ways to collect material.

A study titled "Microbiology for Pharmacy Students" conducted by Dr. L.J. Le Beau of The University of Illinois in 1957 includes the following information. (2)

Textbooks in use (1957)	
Frobisher	22
Kelly and Hite	13
Burrows	7
Sarles	6
Salle	3

Other texts were used, but only in one school each. Fifty-seven per cent were satisfied with the text they were using.

The next step was to send a questionnaire to my colleagues on this panel. I would like to thank them here for their 100 per cent cooperation.

Questionnaire:

1. Name the textbook in pharmaceutical microbiology in use at your school during the year 1960-61.
2. Which school(s) of your university teach a required course for undergraduate pharmacy students?
3. Total number of students enrolled in this course.
4. Number of credits.
5. Professors' undergraduate and graduate specialization.

Results:

1. *Zinsser Microbiology*, Twelfth Edition, Appleton-Century Crofts, New York, used at one college of pharmacy, course taught at the pharmacy school.
2. Frobisher's *Microbiology*, Sixth Edition, W.B. Saunders Co., Philadelphia, used at one college of pharmacy, course taught at the school of pharmacy.
3. Pelczar and Reid's *Microbiology*, McGraw-Hill Book Co., used by

the department of bacteriology, college of arts and sciences.

4. Same text as above used by the department of bacteriology taught in the medical school.

From the limited results, my own thinking on textbook material could be projected, since I am familiar with many in the field.

The choice of a textbook is an important tool to acquaint the professionally orientated student with general and pathogenic microbiology. Exactly what text is used varies to some extent in each college of pharmacy, according to the number of students enrolled, credit hours assigned, and the individuals presenting the course. At Rutger's college of pharmacy, the sixteen-week course is divided into two distinct parts: the first covering the fundamentals and essential aspects of the subject, and the second the pathogenic. Objectives of the course follow to some degree the basic rules and principles outlined in *The Pharmaceutical Survey* (3). This course is presented to pharmacy students only, and it is not, as it often is elsewhere, the same course taught to students at the colleges of arts and science, agriculture, nursing, dentistry, or medicine. Pharmaceutical microbiology should be quite distinct from the microbiology of medicine, nursing, and dentistry.

Frobisher's textbook fits our need for the type of course presented. Mimeographed material is available for those readers interested. (See addendum.) On examination of this material you will note that the suggested chapter readings have not been followed. Additional material was of my own choice.

New editions of textbooks cannot be published yearly. Thus, up-to-date material must be incorporated. The newer antibiotics, sulfonamides, and biologicals should be presented to the student. Microbial problems encountered in the daily practice of pharmacy should be added: practical methods of sterilization and preservation; reliable concentrations of anti-infectives; specific anti-infectives, antibiotics, sulfonamides, and biologicals used against the known microorganisms. I try to keep in mind that I am teaching microbiology to pharmacy students and not making microbiologists out of them. Frobisher's text adequately covers those areas which are essential for an undergraduate course. The ideal textbook has not yet been published. Some of you may think so; some publishers might think so. I agree we have excellent texts to choose from.

The objectives of a good text include some understanding of infectious disease, biological products, epidemiology, and other widely different phases of microbiology. A textbook must be useful, not just incorporating certain facts to be memorized or referred to, but also readable, understandable, and informative.

However, certain aspects of adequate coverage in various areas are lacking in some texts. It would be gratifying to see more coverage of the anti-infectives, the antimicrobials, and the biologicals as they pertain to the practice of pharmacy. Also, it would be helpful to see fewer of the details of research techniques in texts for undergraduate use. I use an extensive bibliography for the preparation of assignments, so that students may acquaint themselves with this type of material available in the library. Directions for the preparation of this manuscript are included in the mimeographed materials appended.

Frobisher's textbook is designed to meet the needs of those students who wish to have a full understanding of the subject, but who cannot find the time to go into all the fine points of theory. Most students have commented favorably on the practical rather than theoretical approach of this text. It is pre-

sented so that the students thoroughly master the basic fundamental concepts and can apply them.

Comparing Frobisher with other general texts I might comment on the duplication of material and poor correlation of some material. I refer specifically to the section on viruses. Chapters five and forty-five need some editing.

Please note that general texts are also mentioned. The Committee on Education, Society of American Bacteriology, has recommended a selected list of general and medical microbiology textbooks. I have taken the liberty to list those available from 1956 to 1960. This does not preclude the deliberate omission of masterly textbooks and specialties published prior to that date. (See addendum.)

If I were allowed by one observation to distinguish between Frobisher's and Pelczar and Reid's texts, I would say that the latter is outstanding because of its excellent schematic drawings, illustrations, tables, and charts. Visual materials such as these are welcomed in an undergraduate text since beginning students will greatly appreciate bacteriologic techniques and facts.

As to some personal negative comments, I am not entirely pleased with their grouping of infectious diseases. Is it wiser to group yeasts, molds, cocci, rods, viruses, etc., under types of airborne infection than by the conventional method of morphological classification? It may, of course, be argued that this may be justified as sections in other texts use the classical system. Space does not permit the review of and comments on other texts. This could be accomplished in subsequent published papers by those interested in the problem.

In order for undergraduate textbooks in "pharmaceutical microbiology" to merit professional use, their scope and content must be designed accordingly. The textbooks must meet the expanding needs of all phases of the profession.

As I look ahead in planning my course in microbiology for pharmacy students, basic requirements are met. After this, material is presented to enhance further those areas which will benefit the profession. Modern methods of treatment for specific diseases and diagnostic methods are included to keep abreast of developments in modern therapy: In conclusion I would recommend:

1. Textbooks in pharmaceutical microbiology should include both the general and pathogenic aspects.
2. Such aspects should emphasize those areas of importance to pharmacy.
3. The general area should cover bacteriological techniques and procedures, etc., the second half devoted to the most important infectious diseases with present-day treatment, i.e., antimicrobial agents, biologicals.
4. The text should be a composite representation of the needs of a biological course taught in a professional curriculum.

References

1. Reddish, George F., *Amer. J. Pharm. Educ.*, **21**, 139(1957).
2. Personal Communication, March 24, 1961, Dr. L.J. Le Beau, University of Illinois College of Medicine, Department of Microbiology, 808 South Wood Street, Chicago 12, Illinois.
3. Blauch, L.W. and Webster, G.L., *The Pharmaceutical Curriculum*, American Council on Education, Washington, D.C. (1952).

Addendum

Pharmaceutical Microbiology
College of Pharmacy
Rutgers—The State University
Michael Iannarone

The course in pharmaceutical microbiology #307 includes both general and pathogenic bacteriology. The course is given the first semester of the junior year. The following hours of study are devoted to the course per week for a sixteen-week period: Lecture and recitation—three hours. Laboratory—three hours (in one day). The number of students registered averages approximately seventy-five. The textbook is *Fundamentals of Microbiology* by Frobisher, Sixth Edition, W.B. Saunders, Philadelphia. The laboratory manual is *Laboratory Guide in Pharmaceutical Microbiology* by M. Iannarone. The textbook is followed closely with lecture material. In the laboratory only the important experiments outlined in the different sections of the manual are performed, such as:

Section I Introduction
- a. Preparation of culture media and glassware
- b. Preparation of agar plates and isolation of pure cultures
- c. Simple and Gram staining techniques
- d. Microbic flora of air: yeasts, molds

Section II Physiology of Bacteria
- a. Study of temperature requirements
- b. Differential media
- c. Germicides
- d. Demonstration of phenol coefficient method, agar cup plate method—use of pharmaceutical preparations.

Section III Applied Bacteriology
- a. Milk analysis
- b. Water analysis

Section IV Infection
- a. Study of Gram positive cocci: Staphylococcus, Streptococcus, Pneumococcus
- b. Study of Gonococcus (special material obtained by local health department)
- c. Study of acid fast organism (sputum of tuberculosis patient obtained from local hospital)
- d. Study of flora of oral cavity (*in vitro* studies using oral preparation)

During the laboratory course two unknown organisms are given to each student for identification. These unknowns include any organisms studied throughout the laboratory course.

Each student is required to write an essay on a microbiological subject selected from a list prepared by the instructor.

Students are divided into specific sections for laboratory instructions.

Syllabus

Pharmaceutical Microbiology #307

PART I

General Bacteriology

Section I Relationships of microorganisms to each other and the living world
1. General orientation
2. Microbiology in pharmacy curriculum
3. History; growth in bacteriology
4. The microscopic world: protozoa, algae, bacteria, molds, yeasts, viruses, rickettsiae

Section II Methods and phenomena of microbiology
1. Optical methods of microbiology
2. Morphology and structure of bacteria
3. Classification
4. Cultivation and growth
5. Effects of physical agents on microorganisms
6. Effects of chemical agents on microorganisms
7. Evaluation of 5 and 6 using laboratory techniques
8. Comprehensive study of known antibiotics and sulfonamide drugs as currently prescribed.

Section III Immunology and microbiology
1. Principles and methods
2. Types of reactions
3. Microorganisms and disease
4. Transmission of disease

PART II

Pathogenic Bacteriology

Section I Mold-like bacteria
1. Tuberculosis and leprosy
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Section II Spiral, flexible bacteria
1. Syphilis
   a. clinical and laboratory diagnosis
   b. history; and method of transmission
   c. present-day treatment

Section III Spiral, rigid bacteria
1. Asiatic cholera
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Section IV Aerobic spore-forming rods
1. Special problems involved
2. Important organisms of the group
   a. *B. subtilis*
   b. *B. anthracis*

Section V Anaerobic bacteria
1. Special problems involved
2. Important organisms of the group
   a. tetanus
   b. gas gangrene

Section VI Corynebacteriacae
1. Diphtheria
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Section VII Spherical bacteria
1. Staphyococci, Streptococci, Pneumococci, Gonococci, Meningococci
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Section VIII Pathogenic gram-negative rods
1. Coliform, Salmonella, Pasteurella, Hemophili
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Section IX Viral-diseases
1. Classification of viral groups
2. Study of known viral diseases
   a. clinical and laboratory diagnosis
   b. history; method of transmission
   c. present-day treatment

Preparation of Paper for Bacteriology Manuscript

All papers submitted should be typewritten with double spacing on one side of good quality paper 8.5″ x 11″ in size and with 1″-1.5″ margin. Each paper submitted should be accompanied by an abstract of not more than 200 words which includes a summarization of conclusions and recommendations. All pages should be numbered consecutively.

The paper should not be more than 1,000 words, which includes a brief summary. All bibliographical references should be checked with the original publications. The student may find it helpful to consult subjects of the same nature in recent issues of the respective journal.

The completed manuscript, i.e., abstract, paper, bibliography, must be submitted in a gray folder. The completed manuscript is non-returnable.

Topics

Topics will be chosen by the student from a series prepared by the instructor. Note should be made that information may be obtained from any source (e.g., college of pharmacy library; Newark library; New York library, etc.)

Selected List of General Textbooks in Microbiology and Medical Microbiology Textbooks from 1956-1960

Committee on Education Society of American Bacteriology

Textbooks—General

Clifton, C. E., *Introduction to the Bacteria,* Second Edition, 558 pp., McGraw-Hill Book Co., Inc., New York, 1958.

Frobisher, M., *Fundamentals of Microbiology,* Sixth Edition, 617 pp., W. B. Saunders Co., Philadelphia, 1957.

Kreuger, W. W. and Johansson, R. D., *Principles of Microbiology,* Second Edition, 564 pp., W. B. Saunders Co., Philadelphia, 1959.

Pelczar, J. J. and Reid, R. D., *Microbiology,* 564 pp., McGraw-Hill Book Co., New York, 1958.

Sarles, W. B., Frazier, W. C., Wilson, J. B., and Knight, S. G., *Microbiology: General and Applied,* Second Edition, 491 pp., Harper Brothers, New York, 1956.

Stainer, R. Y., Doudoroff, M., and Adelbert, E. A., *The Microbial World,* 683 pp., Prentice-Hall, Inc., New York, 1957.

Textbooks—Medical Microbiology

Brooks, S. M., *Basic Facts of Medical Microbiology,* 306 pp., W. B. Saunders Co., Philadelphia, 1958.

Burdon, K. L., *Textbook of Microbiology,* Fourth Edition, 645 pp., Macmillan & Co., New York, 1958.

Burrows, W., *Textbook of Microbiology,* Seventeenth Edition, 945 pp., W. B. Saunders, Philadelphia, 1959.

Carter, C. P. and Smith, A. L., *Microbiology and Pathology,* Sixth Edition, 970 pp., C. V. Mosby Co., St. Louis, 1956.

Carter, C. P. and Smith, A. L., *Principles of Microbiology,* Third Edition, 665 pp., C. V. Mosby Co., St. Louis, 1957.

Dubos, R. J., *Bacterial and Mycotic Infections of Man,* Third Edition, 820 pp., J. B. Lippincott, Philadelphia, 1958.

Gebhardt, L. P. and Anderson, D. A., *Microbiology,* Second Edition, 476 pp., C. V. Mosby Co., St. Louis, 1959.

Jawetz, F., Melnick, J. L., and Adelbert, E. A., *Review of Medical Microbiology,* Third Edition, 360 pp., Lange Medical Publications, Los Altos, California, 1958.

Kelly, F. C. and Hite, K. E., *Microbiology,* Second Edition, 615 pp., Appleton-Century-Crofts, Inc., New York, 1956.

Smith, D. T. *et al., Bacteriology,* Twelfth Edition, 1026 pp., Appleton-Century-Crofts, New York, 1960.

Thompson, L.V.R., *Introduction to the Microorganisms,* Fourth Edition, 580 pp., W. B. Saunders Co., Philadelphia, 1958.

President's Section

OUR COLLEAGUES IN CANADA

It was my privilege to represent our Association at the annual meeting of the Canadian Conference of Pharmaceutical Faculties at Hamilton, Ontario, in August. On the two days immediately preceding this meeting there were sessions of the Canadian Conference on Pharmaceutical Research and the Teacher's Conference. The latter, which is similar to our teacher's seminar in the AACP, was devoted this year to a discussion of the scope of physical pharmacy and its integration into the pharmaceutics area of the curriculum. The sessions of the CCPF were interspersed with those of the annual convention of the Canadian Pharmaceutical Association in a manner similar to that of the annual meetings of the AACP and the A.Ph.A.

The strong bonds of friendship and mutual professional interests that exist between the CCPF and the AACP were evident in the cordial reception and genuine hospitality that were extended to me. In all of their sessions I was given the privilege of the floor and was urged to enter freely into the discussions. The opportunity to become better acquainted with our colleagues in the Canadian colleges of pharmacy, to learn more about their educational and professional problems and aspirations, and to discuss problems of mutual interest to our two organizations was a very gratifying experience.

We have many interests in common with our friends in Canada. Our constitution provides for affiliate membership for Canadian colleges of pharmacy that meet the minimum standards of the CCPF; three of them are currently affiliate members of the AACP. For many years we have enjoyed the presence of a number of deans and teachers from the Canadian colleges at the annual meetings of our Association and at our annual teachers' seminar. Rho Chi, our national honor society in pharmacy, provides for the establishment of chapters in colleges that meet the minimum standards of the CCPF.

Perhaps the strongest bond of all is the large number of graduates from the Canadian colleges who have pursued their graduate studies for the M.S. and Ph.D. degrees in the member colleges of the AACP over the past several years. They have been among the most outstanding of our graduate students. Many of them are now serving on the faculties of the Canadian colleges and in the pharmaceutical industry in Canada. A significant number of them have chosen to remain in the United States, to the great benefit of our own member colleges and our own pharmaceutical industry.

Despite the handicaps imposed by the geographic locations and physical separation of the eight colleges of pharmacy in Canada, I was greatly impressed by their devotion to a common purpose in the CCPF and by the progress they have made in some of their educational and professional problems. We in the

AACP could learn much from them. For example, their use of the term *pharmaceutics* to denote that area of the curriculum which we call pharmacy avoids the use of the same term to denote the profession of pharmacy; it is a practice that we could adopt with profit.

There appears to be a closer relationship between pharmaceutical education and pharmaceutical practice in Canada than we enjoy in the United States. This may be due in great part to the fact that, generally speaking, the educational, practical training (apprenticeship or internship) and licensure requirements to become a pharmacist in any province are set up and administered by the pharmaceutical association (or faculty of pharmacy) of that province, in which body the college of pharmacy is well represented.

Thus, there are no examinations comparable to our state board examinations. The license to practice pharmacy in a given province is granted by the pharmaceutical association (or faculty of pharmacy) to the graduates of the college of pharmacy in that province who have completed the other requirements. The situation is not quite so clear-cut for those graduates of a college in one province who wish to become licensed to practice in another province. But good progress is reported toward a pharmacy examining board of Canada, comparable in function and purpose to a national pharmacy licensing examination that has been advocated but toward which no progress has been made in the United States. All of the provinces, except Manitoba, require practical training (apprenticeship or internship), and, here again, in Alberta and British Columbia, signs of progress are apparent in the manuals for preceptors that have been made available through cooperation between the colleges of pharmacy and the pharmaceutical associations.

We are grateful to the Canadian Conference of Pharmaceutical Faculties and to the individuals in the colleges which comprise its membership for their interest and support of the AACP and its activities. Perhaps this interest has been too much of a one-way street in the past, with our receiving more than we have given. I am pleased to have had the opportunity to show our reciprocal interest and hope that our Association may find it possible to send a representative to their meeting at more frequent intervals in the future.

Lloyd M. Parks

Editorial

It was an ambitious, and possibly an impossible, task that was set for the representatives of the six pharmaceutical organizations who received and accepted an invitation to contribute to the feature section on the national purpose of pharmacy for this issue.* The original idea was that the essays, bringing together the thoughts of individuals intimately concerned with either the retail, the educational, the legal, the organizational, or the industrial areas of pharmacy, could be used to rediscover and to restate the national purpose of pharmacy. There was the hope that from this series might somehow come the answer to all of the trials and tribulations pharmacy now faces.

It should have been realized at the time the series was proposed that a restatement of the ideals of pharmacy, a redefinition of the national purpose of pharmacy, in spite of the finest intentions or resounding rhetoric, are not sufficient in themselves in which to find the remedy to the ills which beset pharmacy.

The remedy to pharmacy's troubles will not come with a new revelation of the ultimate ends, objectives, and commitments of our profession. These are fixed. They are lasting and not disputed. Pharmacy is dedicated to serve mankind, to benefit the public welfare, and to ameliorate the suffering of the afflicted.

It is possible that pharmacy has reached a point in its development and evolution, a point in its relations with the rest of society where what used to be regarded as the program of its national purpose has been fulfilled and outlived. If so, then pharmacy awaits an innovation which will be in the means, in the policies and programs, the measures, by which the ultimate ends of the profession can be realized.

Is this innovation, this something new or novel, to be found in the series comprising the feature section of this last issue of the twenty-fifth anniversary volume of this journal? This revelation may not be discerned easily or immediately in the series, but a careful reading and evaluation of the essays will, I believe, be cause for optimism.

It seems to me that there are three general areas of agreement in the five papers.

First, a reading of the series reveals clearly that the authors of the papers are aware of the current problems confronting pharmacy. This is true not only in the area in which the author has his greatest experience; the essays reveal a unique and broad understanding on the part of each of the authors reaching across the entire pharmaceutical complex. It cannot be said truthfully that the leaders of American pharmacy represented in this series do not know the problems of the day, and do not anticipate some of the problems of the future.

Second, each of the authors comments on the complacency of the rank and file members of the profession. Columnist James Reston has said, "Most of the great political crises of the American past have been resolved, not by the zeal and purpose of the people, but usually

*A paper was not received for publication from the Pharmaceutical Manufacturers Association.

by the willpower or obstinancy of their leaders." This does not seem to hold true with the current crises in American pharmacy. The leaders have the "willpower" or "obstinancy," as you prefer, to cope with the situations confronting them, but they lack (and need) the support of the people of pharmacy. I do not know of a time prior to now when there has been more purposeful thought on contemporary problems in universities, associations, and foundations concerned with pharmacy. But the alliance between them and their associates has been feeble, and somehow it must be restored.

The third area of general agreement I mentioned as noted in the essays is perhaps less obvious than the first two. It is the desire, expressed or implicit, of each of the authors to search actively for the best road into the future. It is the willingness of each of these leaders and the associations they represent to meet the challenges, to mobilize the power to respond to these challenges, and to do so ably.

Competent leaders . . . aware of the problems, but without the backing of their followers—why? Could it be that the followers are confused as to whom they should follow?

Shortly after the appearance of the last issue of this journal a friend wrote to me, "If you are going to preach to us in your editorials, please announce your scripture, chapter and verse." I am reminded of a biblical story that is apropos to this discussion. It is found in Genesis 11:1-9. There is told the story of the Tower of Babel. It seems the builders of this tower could not understand each other. The architects had the know-how, the willpower or the obstinacy to construct the tower, but they were not speaking the same language, and in the confusion the builders scattered and left off building the tower.

There is a lesson in the loss of solidarity. There is a lesson for pharmacy. Solidarity is the situation which comes about when people find that their best interests are bound together by common loyalties and common services.

The best interests of pharmacy will be based solidly when there is the realization that all areas of the profession—the retail, the educational, the legal, the organizational, the i n d u s t r i a l—are bound together by common loyalties and common services; when all of these areas speak a common language.

I do not mean "One Voice for Pharmacy." It is, perhaps, only an exercise in semantics, but the term "one" brings to the mind of many the meaning of a single voice, a single organization, a loss of identity for some of the respected and necessary organizations and associations now serving useful purposes in the pharmaceutical complex. My plea is for a *mutual* pharmacy, wherein is stressed a sharing of responsibility and obligation, equally and jointly. Not one voice for pharmacy, but many voices, all speaking in harmony, in balance, in concert.

This is the innovation for which pharmacy is waiting. Some will say this is neither new nor novel, that the idea has been proposed for years. I submit that until the proposal becomes a reality it is a new idea, it is novel—and it is possible. Recent news releases report the call for "a United Nations" approach to bring pharmacy's leaders together. Who is best prepared and most logical to issue this call?

I suggest that the American Association of Colleges of Pharmacy assume this responsibility. The organization is in a position to take the lead in mobilizing pharmacy's power to devise ways of protecting our vital interests and fulfilling the commitments of our profession. The AACP has the services of a competent executive secretary-treasurer whose stature in the world of pharmacy

is recognized and respected, and who has the personal ability and integrity to guide pharmacy to a deep reformulation of the policies and programs demanded by a very different society from that of a generation and more ago.

I propose that the American Association of Colleges of Pharmacy invite responsible individuals from each of the national associations concerned with pharmacy to a summit meeting to be convened in Washington, D.C. at the earliest possible date to consider ways and means of using the great energies of each of the organizations in responding collectively to the challenges which pharmacy now faces.

The time for action is now. Reliable persons have indicated that pharmacy may have no more than two years in which to create a favorable professional image before a decision by the Supreme Court agrees or disagrees with the premise that pharmacy is a profession. The time for bringing a halt to internecine disunity is now. Even working smoothly together, even inspired by the enthusiasm of yore, pharmacy's leaders will have to face up to a perplexity of problems.

The events and decisions of the next few months will decide the fate of pharmacy for the next twenty-five years and longer. In my editorial in the first issue of this volume commemorating the twenty-fifth year of publication of this journal I made the following comment and asked the following questions. They bear repeating.

> In 1986 . . . someone . . . may look back at those of us now active in pharmaceutical [activities] and examine our writings, our efforts, our work. By what will we be known? By what will we be remembered?
>
> Will we be recalled with fondness and gratitude for our successes in protecting and progressing pharmacy, or with bitterness and regret for our lack of accomplishment and our failures? Will we be known as persons who promised and kept the faith, or as those who accepted responsibility and failed to fulfill the pledge? Will we be remembered as persons who contributed to the good life of pharmacy, as persons interested in the welfare of all? Or will we be recalled as persons who received but did not give, who lived selfishly to ourselves and for ourselves with no concern for our colleagues and no interest in the common good of all?

"MENE, MENE, TEKEL, UPHARSIN."

C. Boyd Granberg

Announcements

Drugs for Science Projects in High Schools. Karl L. Kaufman, chairman of the AACP Committee on Recruitment Aids, has recently released the following information concerning prescription drugs and high school science projects.

"Pharmacists may furnish prescription drugs for science projects (such as science fairs) conducted in high schools under regulation 1.106(m) of the federal Food, Drug and Cosmetic Act.

"This can be an important means (1) of informing the pupils and teachers of the science-oriented nature of the pharmacy curriculum, (2) of showing pharmacy's place on the health team, (3) of acquainting the public with the variety of opportunities in the profession, and (4) of interesting more qualified youngsters in the study of pharmacy.

"Follow these rules (as a minimum) in dispensing the drugs: (1) dispense only to the teacher-sponsor, (2) make an accurate record of a) name and location of the teacher, b) date of transaction, and c) identity and amount of drug dispensed. It may be well to note the nature of the project with the other information. The pharmacist is responsible for determining that the request is bona fide and that only a reasonable amount of the drug is dispensed."

AIHP Awards Urdang Medal. The seventh George Urdang Medal will be conferred upon General (Dr.) Rafael Roldan y Guerrero, pharmacist-historian of Madrid, Spain, by the American Institute of the History of Pharmacy.

The George Urdang Medal honors unusually distinguished historical publications on pharmacy appearing anywhere in the world.

In recommending the Spaniard as the seventh Urdang Medalist, the evaluation committee cited particularly his five-volume work (in press), *Diccionario Biografico y Bibliografico de Autores Farmaceuticos espanoles, desde el siglo VIII hasta 1944*. The dictionary, which in part has appeared serially, covers nearly 2,500 Spanish pharmaceutical authors between the eighth century and the present.

A presentation ceremony conferring the Urdang Medal upon General Roldan was conducted during the International Congress of the History of Pharmacy at Innsbruck, Austria, in September.

Lascoff Memorial to Apple. William S. Apple, secretary and general manager of the American Pharmaceutical Association, has been designated to receive the American College of Apothecaries' 1961 J. Leon Lascoff Memorial Award. The award, named in honor of the famous pharmacist and one of the Founders of the ACA, J. Leon Lascoff, is presented to that individual who, in the opinion of the committee, has contributed the most to the advancement of professional pharmacy.

Dr. Apple's pharmaceutical background has been one of outstanding service. In education, as head of the department of pharmacy administration at the University of Wisconsin; in association work, as vice president, president and chairman of the Board of Directors of the Wisconsin Pharmaceutical Association; in retail pharmacy, registered in the state of Wisconsin, and in the

armed services as a major assigned to the staff of Fleet Admiral Nimitz, he has performed efficiently and effectively.

The award was presented to Dr. Apple at the convention of the American College of Apothecaries on October 2nd at the Jack Tar Hotel in San Francisco, California.

Bianculli Named Dean. Dr. Joseph A. Bianculli, acting dean for the past three years, has been named dean of the University of Pittsburgh School of Pharmacy. His appointment as fourth dean of the eighty-three-year-old school was recently announced by Pitt Chancellor Edward H. Litchfield.

A native of Pittsburgh, Dr. Bianculli received the B.S. in Chemistry degree at Pitt, the B.S. in Pharmacy degree at the Pittsburgh College of Pharmacy, and the Ph.D. degree in organic chemistry at Pitt. He spent three years as development chemist at American Cyanamid in Bridgeville, Pennsylvania, and three years as assistant director of chemical research at Reed & Carnrick in Jersey City, N.J. He joined the school of pharmacy faculty in 1948 as assistant professor of pharmaceutical chemistry.

New AACP Publication. Executive Secretary Bliven has initiated the publication of a *Newsletter* to be distributed periodically to member colleges of the Association. Volume I, Number 1 was distributed under date of September 12, 1961. The first issue commented on the proposed manpower survey of pharmacy, legislation affecting the profession, suggested reading, and information regarding selective service, among other items. The *Newsletter* will serve a useful purpose in keeping Association members informed of current activities in the Association office and of the many issues confronting pharmaceutical education.

AACP Office Initiates New Service. The first issue of the AACP *Newsletter* announced the establishment of a new service to teachers and administrators of member schools of the Association. According to the announcement, "The AACP office will receive the names and addresses of teachers who seek a position in teaching, government, or industry and will make known your desires to prospective employers. In the same manner, 'positions open' will be received from deans of member schools.

"All requests for positions will be handled on a confidential basis when so requested."

Secretary Bliven has emphasized that the program is an employment service, not a shopping service.

Costello to Retire. It is announced that Mr. Patrick Henry Costello will resign his position as secretary of the National Association of Boards of Pharmacy on July 1, 1962. Mr. Costello has served as secretary for the past nineteen years. No successor to Mr. Costello has been announced.

Research Career Award Program. Copies of the *Information and Policy Statement on Research Career Award Program* (July 24, 1961) are available by addressing the Division of Research Career Development Awards, National Institutes of Health, Bethesda 14, Maryland.

The purpose of the program and the awards available are as follows:

> Research Career Awards are available to institutions in the United States on behalf of qualified candidates to provide increased numbers of stable career opportunities for scientists of superior potential and capability in the sciences related to health. Awards are intended to provide individ-

uals with some measure of assured support reasonably early in their careers. Two groups of awards are available as follows:

A. *Research Career Awards.* Awards in this group are intended to finance additional stable positions for experienced investigators who are continuing to develop in productive careers of independent research and teaching. Awards are made on the basis of nationwide competition, and the research standards expected of candidates are high.

B. *Research Career Development Awards.* Awards in this group are intended to finance positions for able scientists who plan to pursue careers in independent research and teaching. These awards are for young investigators who desire experience and further training in a productive research environment as well as for scientists undertaking independent research who need further experience to qualify for senior positions.

The Research Career Development Awards may be made for initial periods of five years and may be renewed for an additional five years. The Research Career Awards are awarded in five-year increments and are made with the "firm intention" to continue federal support for the full career of the individual. The awards may not exceed $25,000 per year.

The recipients are directly responsible to the institution but awardees must devote themselves ". . . . substantially to research and research training." The awards are not transferable to another institution should the awardee change positions. The initial award to an individual will be made, in most instances, before he is forty-five years of age.

AFPE Roster. The 1961 edition of the American Foundation for Pharmaceutical Education *Roster* has been distributed. The brochure details the programs of the AFPE and lists the fellows of the Foundation. The booklet is available from the Foundation office, 777 Fourteenth Street, N.W., Washington 5, D.C.

BIRTHS

Susan Marie Brannon—born July 13, 1961, to Dr. and Mrs. James L. Brannon. Dr. Brannon is assistant professor of pharmacy at the University of North Carolina.

Susan Petersen—a daughter, born to Dr. and Mrs. Robert V. Petersen, University of Utah, June 6, 1961.

Lorin Karsten Roskos—son, born to Mr. and Mrs. John Roskos, Jr., Mercer University, August 2, 1961.

Sarah Elizabeth Thacker—born April 2, 1961, to Mr. and Mrs. Willard D. Thacker. Mr. Thacker is chief pharmacist at the West Virginia University Hospital and a member of the staff of the school of pharmacy.

John Joseph Ruggiero—a son born to Dean and Mrs. John S. Ruggiero, Duquesne University, May 5, 1961.

Matthew Beryl Koss—born September 16, 1961, to Mr. and Mrs. Frederick Koss. Mr. Koss is assistant professor of economics at the New England College of Pharmacy.

Richard Roger Reopelle—son, born on July 1, 1961, to Mr. and Mrs. Richard N. Reopelle. Mr. Reopelle is at the North Dakota State University College of Pharmacy.

Susan Ranee Jones—born September 21, 1961, to Dr. and Mrs. Tony E. Jones. Dr. Jones is associate professor of pharmaceutical chemistry, University of Colorado.

David Michael Platcow—born June 29, 1961, to Dr. and Mrs. Edward S. Platcow, Northeast Louisiana State College.

MARRIAGES

Dr. Theodore D. Sokoloski, assistant professor of pharmacy, to **Dr. Gail Plourde,** assistant chemist, division of industrial research, both at Washington State University.

Mr. Stanley M. Shaw, instructor in pharmaceutical chemistry at South Dakota State College, to Miss Excellda J. Watke, August 13, 1961.

Dr. William Hersh Golod, Medical College of South Carolina, to Miss Marsha Berebitsky on June 24, 1961.

NEW STAFF MEMBERS

University of Kentucky. Mark M. Luckens, who received his B.S. degree in chemistry from Columbia University, M.S. in industrial hygiene and toxicology from New York University, and Ph.D. in pharmacology from the University of Connecticut, has been appointed assistant professor in the materia medica department of the college of pharmacy of the University of Kentucky and consultant to the Kentucky State Department of Health.

Temple University. Dr. Theodore S. Kallelis has joined the faculty as associate professor of pharmacognosy beginning with the academic year 1961. Dr. Kallelis is a graduate of Tufts College and the Massachusetts College of Pharmacy. He received the M.S. degree from Temple University School of Pharmacy and Ph.D. from the University of Maryland. He formerly taught at Fordham University.

Mr. Nagindas K. Patel has joined the department of pharmacy as a part-time instructor and research assistant. Mr. Patel is a graduate of Lallubhai Motilal College of Pharmacy, India, and received an M.S. degree from Temple University. He has completed requirements for the Ph.D. at the University of Maryland and will conduct postdoctoral research under the supervision of Dr. Harry Kostenbauder.

Columbia University. The appointment of Dr. Gilbert J. Hite, as assistant professor of pharmaceutical chemistry, has been announced by the Columbia University College of Pharmacy. Dr. Hite received his graduate training at the University of Wisconsin and spent two years on the faculty of the Howard University College of Pharmacy.

University of North Carolina. Paul Joseph Wurdack has been appointed assistant professor of pharmacy. Prior to accepting this position he was a staff member at the University of Pittsburgh, where he had also received the doctoral degree.

James Clarence Kellett, Jr. has been appointed assistant professor of pharmacy. He received his doctoral degree from Purdue University during the summer.

Miss Margaret Ann Shaw has been appointed assistant professor of pharmacy. She completed her requirements for the doctoral degree at the University of Florida.

Jack Knight Wier has been appointed

assistant professor of pharmacognosy. He received his doctoral degree from the University of Washington.

Philadelphia College of Pharmacy and Science. The following individuals have been appointed to the listed positions. Patrick Echlin, instructor in botany; Robert W. Downing, assistant professor of psychology; James R. Parmenter, instructor in philosophy; Albert R. Schmitt, instructor in German; John M. Ridge, assistant professor of mathematics and physics; Wallace Growney, instructor in mathematics and physics; Robert E. King, associate professor of pharmacy; James T. Doluisio, assistant professor of pharmacy; Paul J. Niebergall, assistant professor of pharmacy; Luis Hernandez, instructor in pharmacy.

University of Florida. Dr. Edward R. Garrett has been appointed graduate research professor of pharmacy. Dr. Garrett was formerly at The Upjohn Company, Kalamazoo, Michigan.

Dr. C. M. Mokler has been appointed assistant professor of pharmacology. Professor Mokler was formerly at G. D. Searle & Co., Chicago, Illinois.

University of Rhode Island. The following appointments have been made to the staff of the college of pharmacy: Dr. Bruce A. Brown, assistant professor of pharmaceutical chemistry; Dr. David W. Coates, instructor in pharmacology; Mr. David R. DeFanti, assistant professor of pharmacology; Dr. Michael D. Jacoff, assistant professor of pharmacy administration; and Mr. James Price, instructor in pharmacy.

University of Kansas. Vernon R. Gleissner has been appointed instructor in pharmacy.

Southwestern State College. Mrs. Ina G. Black has been appointed associate professor of pharmacy.

Oregon State University. Mr. Edward Holland, who received his M.S. degree from Oregon State University, has been appointed instructor of pharmaceutical chemistry.

Ohio State University. Dr. Harold H. Wolf, who recently completed his Ph.D. at the University of Utah, has been appointed assistant professor in pharmacology, effective September 1, 1961.

University of New Mexico. Dr. Victor H. Duke has been appointed assistant professor of pharmacology. Dr. Duke received his Ph.D. at the University of Utah, June, 1961.

Duquesne University. Mr. Bruce A. Martin, assistant professor of pharmaceutical chemistry, has been appointed administrative assistant to Dean Ruggiero effective June 1, 1961. He will receive his Ph.D. in December, 1961.

The North Dakota State University. Philip Haakenson has joined the staff as instructor in pharmacy administration, and Ralph Boehm as half-time instructor in pharmacy.

Richard W. Prouty became associated with the college of pharmacy October 1 in the position of state toxicologist. Mr. Prouty was previously at the University of Maryland.

Howard College. Dr. Jean Mead Dunbar has been appointed professor of pharmacy. Dr. Dunbar was formerly at the University of Illinois.

University of Arkansas. Dr. S. B. Britton has been appointed assistant professor of pharmaceutical chemistry effective September 1, 1961. Dr. Britton was formerly employed with the Union Carbide Chemicals Company, New York city.

University of Connecticut. Dr. Karl A. Nieforth has been appointed assistant professor of pharmaceutical chemistry. Dr. Nieforth received his Ph.D. at Purdue University, majoring in pharmaceutical chemistry.

University of California. Robert A. Mirigian, who received his B.S. and Doctor of Pharmacy degrees in 1959 at the University of California School of Pharmacy, was appointed lecturer in pharmacy, effective July 1, 1961.

Dr. Richard P. Penna, also a graduate of the University of California School of Pharmacy, has been appointed assistant clinical professor of pharmacy effective September 1, 1961.

Mr. Victor A. Garlin has been appointed lecturer in pharmacy administration effective July 1, 1961.

Massachusetts College of Pharmacy. Four appointments to the staff are: Dr. William H. Parsons as associate professor of physics and mathematics; Norman R. Campbell as instructor in pharmaceutical administration; Dr. Robert S. Fishman as instructor in mathematics; and Myron Segelman as assistant in biological sciences.

University of Georgia. Dr. Kenneth L. Waters, dean of the school of pharmacy, has announced the addition of three members to the teaching staff, Professors Ben F. Cooper, Donald E. Cadwallader, and W. Frank Dobbs.

CHANGES IN STAFF TITLES

University of Oklahoma. Miss V. Jean Brown has been promoted from assistant professor of pharmacy to associate professor.

West Virginia University. Mr. Alfred C. Core, who recently completed all of the requirements for the Ph.D. degree at the University of Illinois, has been promoted to assistant professor of pharmaceutical chemistry.

University of Texas. Dr. Frank Cosgrove, Dr. W. L. Guess, and Dr. Esther Jane Hall have been promoted to associate professorships.

Duquesne University. Mr. Anthony J. Amadio has been promoted to assistant professor of pharmaceutical administration.

Ohio State University. Dr. David E. Guttman has been promoted from assistant professor to associate professor of pharmacy effective July 1, 1961.

University of Washington. Dr. Varro E. Tyler, Jr. has been promoted to full professor of pharmacognosy.

University of Arizona. Mr. Richard F. Childs has been promoted from instructor to assistant professor of pharmacy. During the past two years Mr. Childs has been on leave of absence while completing his doctoral studies at Purdue University and the University of Arizona.

New England College of Pharmacy. Mr. Joseph L. Labrecque has been promoted to instructor in pharmacy, and Walter G. Osiecki has been promoted to instructor in pharmacognosy and biology.

Massachusetts College of Pharmacy. Four promotions announced are: Dr. Sumner M. Robinson, from instructor to assistant professor of biology and pharmacology; George Narinian, from assistant to instructor in pharmacy; Abraham J. Haddad, from assistant to instructor in physics and pharmacy; and George C. Page, from assistant to instructor in biological sciences.

Memorials

LOUIS R. STEZZI

Dr. Louis R. Stezzi, assistant professor of chemistry at Temple University School of Pharmacy, died on September 5, 1961, at his home in Broomal, Pennsylvania. Death was caused by a sudden heart attack.

Dr. Stezzi was born September 16, 1924, in Philadelphia, Pennsylvania, and was a graduate of South Philadelphia High School. He graduated from Temple University School of Pharmacy in 1948 and subsequently received a Master of Science degree from that same institution in 1951. From 1948 until 1952 he served on the faculty of the school of pharmacy as an instructor in inorganic chemistry. He was awarded the Doctor of Philosophy degree from Georgetown University in 1957.

Dr. Stezzi served as a faculty member at the University of Maryland from 1952 until 1954 and rejoined the faculty of Temple University School of Pharmacy in 1955. Faculty, alumni, and students deeply mourn the loss of a fine educator and individual. He proved his ability to work successfully with young people and endeared himself to all of those with whom he dealt. He served as a coach to the Temple University School of Pharmacy basketball team at the time the team was a member of the Eastern Inter-Collegiate Pharmacy Basketball League. He was a member of the Kappa Psi fraternity, the American Pharmaceutical Association, and the American Chemical Society. He is survived by his wife, the former Lucille Solometo.

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ONA KENNETH DEFOE

The unexpected death of Ona Kenneth DeFoe on June 29, 1961, came as a great shock to his many friends, students, and colleagues at the St. Louis College of Pharmacy. Professor DeFoe had taught his morning class and had then left the college building to enjoy working his garden plot in suburban Webster Groves. To a young colleague, Taylor Lindhorst, who had expected to have lunch with him, Dr. DeFoe left this prophetic note: "Dear Taylor: I've gone to the garden and I won't be back. There's not a cloud in the sky." It had been raining almost daily, and O.K. meant to make the most of this beautiful, cloudless day. It was warm; early in the afternoon he collapsed. At St. Louis County hospital he was pronounced dead of a heart attack.

Hale and hearty at sixty-three, strong and vigorous in body and mind, O. K. DeFoe was in the prime of life. A daily inspiration to both students and faculty, he tried to teach people to think rather than to learn. A man of catholic interests, he would discuss a fine point of English grammar, a principle of genet-

ics, or a problem in nuclear physics with equal thoroughness and perception. He was fascinated by words, intensely interested in their etymology, denotation, and connotation; he enlivened the luncheon club with his stimulating curiosity.

As professor of mathematics and physics Dr. DeFoe served the best interests of the profession of pharmacy for thirty years, always stressing the pharmacist's need for a broad education in the liberal arts. At Washington University in St. Louis, where he had worked with Arthur Holly Compton, he earned the M.S. and Ph.D. degrees. He had received the A.B. degree from Drury College, in his beloved Ozarks. Dr. DeFoe was a seasoned teacher and scholar when he joined the faculty of the St. Louis College of Pharmacy with the advent of the four-year course requirement, and he was one of the leaders in shaping the curriculum for the five-year course.

As a young man O. K. DeFoe served in the United States Army during World War I; he taught at several schools and colleges before and after his graduate study; he pioneered in modern atomic research; he was awarded many honors; he became a member of a number of learned societies; but once he joined the faculty of the St. Louis College of Pharmacy he put pharmacy and pharmaceutical education first and energetically supported every effort to improve the profession through higher standards of education and professional ethics.

A strong but gentle man, Ona K. DeFoe "loved to see things grow" and had planned to spend his retirement years "growing things," both indoors and out. Fort thirty years he was host to his colleagues at the college on an annual fishing trip on the beautiful Gasconade River. His fatherly interest in the younger members of the faculty was apparent to students and visitors alike. We shall miss his guidance and kindly counsel, his capacity for mature tolerance as well as for righteous indignation.

Dr. DeFoe is survived by his widow, Nettie, and by three sisters, Mabel Abernathy, Clara Lessly, and Ethel Cole. He was laid to rest on July 1, 1961, in Laurel Hill Gardens, St. Louis County, Missouri.

Walter Rist

General News

ASP honorary memberships. At its recent meeting in Houston, Texas, the American Society of Pharmacognosy presented honorary membership to three distinguished pharmacognosists. The recipients were Dr. Heber W. Youngken, Sr., professor emeritus of pharmacognosy, Massachusetts College of Pharmacy; Mr. John Seybert, retired chief pharmacognosist, Eli Lilly and Company; and the late Dr. Earl B. Fischer, formerly professor of pharmacognosy, University of Minnesota. The American Society of Pharmacognosy selects its honorary members on the basis of long and distinguished service to pharmacognosy.

ASP installs officers. The American Society of Pharmacognosy in its recent annual meeting in Houston, Texas, installed the following officers: president, Dr. Norman Farnsworth, University of Pittsburgh; vice president, Dr. Jack Beal, Ohio State University; secretary, Mr. Rolf Westby, Eli Lilly and Company; treasurer, Dr. Frank Crane, University of Illinois.

New publication. *Pharmacy Management*, edited by H. W. Tomski, is published by Pharmaceutical Business Analysis Service, 64 Boldmere Road, Eastcote, Pinner, Middlesex, England. The annual subscription is two guineas (sterling).

Mrs. Jordan dies. Mrs. Helen Byrnes Jordan died on August 24. Mrs. Jordan was the widow of the late Professor Charles B. Jordan, former dean of the school of pharmacy at Purdue University. Professor Jordan, a member of the Purdue University faculty for thirty-one years, died in 1941.

AHFS moves. The office of the American Hospital Formulary Service, a publication of the American Society of Hospital Pharmacists, has been established at Society Headquarters in the American Institute of Pharmacy, Washington, D.C. All inquiries and correspondence concerning the Formulary Service and all orders for the publication should be directed to: American Hospital Formulary Service, American Society of Hospital Pharmacists, 2215 Constitution Avenue, N.W., Washington 7, D.C.

Kremers award nominations. Nominations for the first Edward Kremers Award for distinguished historical writing about pharmacy by an American will be accepted until 31 December 1961. An official form upon which to recommend a candidate for the first Edward Kremers Award may be obtained by request to the Institute's secretary, Ernst W. Stieb, 356 Pharmacy Building, Madison 6, Wisconsin.

According to the Institute's director, Glenn Sonnedecker, the Kremers Award will be bestowed upon an American citizen "for an original publication or series of related articles about historical aspects of pharmacy." Unpublished manuscripts also may be considered. "An expert committee," he noted, "will judge the entries on the basis of competence of research, interpretation and presentation."

Keenan chosen president. Dr. Vincent J. Keenan has been elected president of the Philadelphia College of Pharmacy and Science to succeed the late Dr. Ivor Griffith. In this post he will direct an extensive development and expansion program authorized by the board of trustees.

AFPE awards. The American Foundation for Pharmaceutical Education has distributed $22,400 in 1961-62 undergraduate scholarship funds to fifty-nine colleges of pharmacy, Dr. W. Paul Briggs, executive director of AFPE, has announced.

AFPE scholarships are awarded by the colleges to outstanding junior and senior pharmacy students in need of financial assistance, and are available to all colleges of pharmacy. One hundred and fifty-nine AFPE scholarships were awarded last year.

Also, sixty-eight outstanding scholars received AFPE graduate fellowships for 1961-62. These awards at twenty-seven colleges and universities total $140,000 for the current academic year.

The Foundation has supported 528 fellows in Ph.D. studies. Two hundred and one of these AFPE fellows are now teaching in sixty-seven colleges of pharmacy; one is a college president, one is dean of a graduate school, and sixteen are college of pharmacy deans. One hundred and sixty-five fellows are associated with the drug industry. Thirty-one

are continuing graduate and postdoctoral studies and others are engaged in various professional services and in research activities throughout the government and in hospitals and industry.

Gibson attends Virginia. Dr. Melvin R. Gibson of Washington State University attended a course in nuclear science this summer at the University of Virginia.

Research improvements at WSU. Research facilities in pharmacy are being expanded at Washington State University by the addition of a new laboratory for graduate students in industrial pharmacy, a new area for liquid and ointments in the industrial pharmacy laboratory, a new instrument room, and a new control laboratory for drug service. In addition, new office facilities for the instructor in industrial pharmacy will be constructed.

Albers in Ethiopia. Dr. C. C. Albers, University of Texas, has been granted leave of absence for the current year. He has been invited to cooperate in the establishment of a college of pharmacy at the National University in Ethiopia.

Redman sabattical in Mexico. Dr. Kenneth Redman, head of the department of pharmacognosy at South Dakota State College, has taken a nine-month sabattical leave of absence for travel and study in Mexico. During the year Dr. Redman plans to do scientific writing particularly on agricultural pharmacy, and under the auspices of the U.S. Department of State's educational and cultural exchange program will visit the several colleges of pharmacy in Mexico. He also plans to give guest lectures on the production of plant drugs in the United States. In Mexico he will study production of crude drugs such as vanilla, sarsaparilla, and jalap. Dr. and Mrs. Redman will return to Brookings in June, 1962.

Hiner recovers. Dean L. David Hiner of the University of Utah is back in the office and recovering from eye surgery involving the removal of a cataract from the right eye on June 6, 1961.

Auxiliary donation to Oregon. The Women's Auxiliary to the Oregon State Pharmaceutical Association has presented $1,000 to the general fund of the Pharmacy Foundation of the school of pharmacy. The money will be used to purchase equipment. In addition, the group for many years has supported two annual scholarships for women in pharmacy.

Wilson to nomenclature board. Dr. Charles O. Wilson, Oregon State University, has been appointed by the United States Pharmacopeia Committee as its representative to the Nomenclature Review Board. The board is composed of representatives from the American Medical Association, the FDA, and the Pharmacopeia Committee.

Golod directs pharmacy service. Dr. William H. Golod, assistant professor of pharmacy at the Medical College of South Carolina, has also been appointed director of pharmacy service in the teaching hospital of the Medical College of South Carolina. Dr. Golod had his undergraduate training in pharmacy at Fordham; he took his master's at the St. Louis College of Pharmacy and Allied Sciences, and his doctorate at Purdue.

Harris honored. Dr. Loyd E. Harris, Ohio State University, was honored last May at the convention of the Oklahoma Pharmaceutical Association where he served as a guest speaker. He was presented a plaque by the University of Oklahoma Alumni Association in recognition of his outstanding service to pharmacy.

Institutional name changes. The division of pharmacy of Ferris Institute is now officially a school of pharmacy, according to Dean Claus.

Dean White has announced that the school of pharmacy of Washington State University is now a college of pharmacy.

Eugere elected. Dean Edward J. Eugere of the Texas Southern University was recently elected president of the Houston Pharmaceutical Association and re-elected secretary of the Lone Star State Pharmaceutical Association.

New Building at USC. Ground was broken on September 11, 1961, for the new Life Sciences Building to house the school of pharmacy and the department of biology at the University of South Carolina. The new building will contain 54,000 sq. ft. of floor space, of which pharmacy will occupy approximately 45 per cent. It is anticipated that the new building will be ready for occupancy not later than August, 1962.

Nelson opens Texas series. Dr. Eino Nelson, associate professor of pharmacy at the University of California College of Pharmacy, opened the fifth annual lecture series in the college of pharmacy at the University of Texas, on October 2-4, 1961. He discussed "Kinetic Studies on the Metabolism and Excretion of Drugs by Man."

Willits tour Europe. Mr. and Mrs. Lyle Willits of the University of Kansas City are presently touring Europe. Mr. Willits is on sabbatical leave from the university and is studying the practice of pharmacy in Europe.

Sudro Hall dedicated. Dedication ceremonies for Sudro Hall (pharmacy building) at the North Dakota State University were held October 8 with Dr. George F. Archambault as the principal speaker. A portrait of former dean William F. Sudro was presented at that time.

Add manufacturing. The Drake University College of Pharmacy has initiated a course in manufacturing pharmacy beginning with the fall term 1961. Several pieces of equipment have been purchased including a tablet machine, tablet coater, granulators, homogenizer, roller-type ointment mill, and mixers. Part of the funds for the equipment came as a grant from the Walgreen Company.

Dr. William F. Morgan dies. The Brooklyn College of Pharmacy lost one of its oldest alumni and most respected professors in the death on September 20 of eighty-seven-year-old Dr. William F. Morgan, a graduate of the class of 1895 and member of the faculty for forty-four years until his retirement in 1957.

Death reported. Dr. Rudolph F. King, vice president, director of development, and trustee of New England College of Pharmacy, died September 9, 1961, at his home in Millis, Massachusetts.

Ligorio retires. Dr. Cosmo Ligorio has retired after thirty-two years of teaching at Long Island University's Brooklyn College of Pharmacy where he was chairman of the physics department and director of the first radio-isotope laboratory in a pharmacy college in N.Y. State.

Dr. Ligorio has been granted the rank of professor emeritus by the board of trustees, with the privilege of using his old laboratory and other college facilities to continue his own research projects.

Postdoctoral associates at Wisconsin. Postdoctoral research associates in pharmaceutical chemistry with Professor S. Morris Kupchan at the University of Wisconsin School of Pharmacy for 1961-1962 include: Professor Eiichi Fujita, Tokushima University; Professor Nobukatsu Katsui, Hokkaido University; Professor Raymond Doskotch, University of Wisconsin; Dr. Alan F. Casy, Chelsea College of Science and Technology; Dr. G. W. A. Milne, University of Manchester; Dr. John Knox, University of Western Australia; and Dr. Mendel Friedman, University of Chicago.

NIH grant for historical studies. Dr. Ernst W. Stieb of the University of Wisconsin School of Pharmacy has been awarded an NIH research grant for historical studies in pharmacy on the subject "The History of Pharmacy in Wisconsin, 1848-1948." As far as is known, this is the first such grant to have been made in support of historical studies in pharmacy.

Mattocks resigns. Dr. Albert Mattocks, professor of pharmacy at the University of Michigan, resigned his post November 1, 1961, to take a position at the R. P. Scherer Company in Detroit.

Visitors at California. Mr. Sadao Hirota and Dr. Kozo Shinoda, two graduates of the University of Yokohama who are associated with the Dai-ichi Seiyaku Company, a Japanese pharmaceutical manufacturing firm, visited the school of pharmacy last July. The school had another visitor from Japan on August 31, Dr. Yoshihiro Nagakura, a member of the staff of the University of Kyoto.

Postdoctoral work at UC. Mohamed M. Abdel Khalek, assistant professor on the pharmacy faculty at the University of Alexandria, Egypt, will be doing postdoctoral research at the University of California School of Pharmacy from September, 1961, to June, 1962, under the auspices of a Fulbright grant.

Dean Nouri Y. Mary, of the college of pharmacy, Baghdad University, will be a postdoctoral fellow at the University of California School of Pharmacy from September, 1961, to September, 1962, working with several faculty members on the chemistry of natural products.

Dr. Noel Gordon Carr, formerly a graduate student at Oxford University, will carry out research on "Biological Ester Formation by Hemiacetal Oxidation" at the school of pharmacy from September, 1961, to September, 1962, under the direction of Dr. John J. Eiler, professor of biochemistry and pharmaceutical chemistry. Another Fulbright fellow, Dr. Horst Haerle, formerly a postdoctoral researcher at Vanderbilt University, will work with Dr. Craig on the same research from September, 1961, to September, 1962. Dr. Craig received a grant from the National Institutes of Health to carry out this work.

Hartung dies. Dr. Walter H. Hartung, chairman, department of chemistry and pharma-

ceutical chemistry, Medical College of Virginia, passed away September 29, 1961. The passing was sudden with a major coronary attack.

Cosmetics secretary. Walter G. Fredell has been appointed assistant secretary to the Committee on Cosmetics of the American Medical Association. Mr. Fredell has recently been engaged in research and development of pharmaceuticals and cosmetics and previously was associate professor of pharmacy at Drake University and taught at St. Louis College of Pharmacy.

Grants received or renewed. Dr. Ronald E. Orth, University of Kentucky, received $3,000 from Parke-Davis and Company and $3,300 from the National Institutes of Health to pursue research in the synthesis of symmetrical five-membered N-heterocyclic aromatic substituted thioureas for use as thyroid inhibitors.

Dr. Arthur C. Glasser, University of Kentucky, has received a $5,100 grant from NIH to pursue research on the synthesis of thiourea derivatives for use as antitubercular agents.

The University of Rhode Island College of Pharmacy has received the following research grants: A three-year, $34,500 grant from the USPHS to Professors Smith and DeFeo to study the synthesis of CNS active trimethoxyphenol analogs; a three-year, $21,978 grant from the USPHS to Dr. Buday to study thyroid, MAO, and sympathomimetic amine interactions; a one-year, $1,256 grant from the USPHS to Dr. Buday to study myo-neurohormonal pharmacologic interactions; a one-year, $3,914 grant from the Rhode Island Heart Association to Dr. DeFeo to study the pharmacology of cardioplegic agents; a summer, 1960, $500 grant from the URI Research Fund to Dr. Tsao to study the biosynthesis of digitalis; a summer, 1960, $450 grant from the URI Research Fund to Prof. Sinsheimer to study pharmaceutical chemistry; a summer, 1960, $300 grant from the URI Research Fund to Dr. Osborne to study pharmacy history of Rhode Island; and a February, 1961, $175 grant from Regal Chemical Co., New York, to Professors Youngken, Osborne, and Gerraughty to study formulation of special dosage forms.

Dr. Melvin R. Gibson, Washington State University, received a research grant for $40,000 from the National Institutes of Health. The grant is for the investigation of biosynthetic relationships in the *Solanaceae*. Approximately one-third of the funds will be used in rebuilding the former editorial offices of the *Journal* into a new pharmacognosy research laboratory.

Dr. Mathias P. Mertes, University of Kansas, has been awarded a National Science Foundation fellowship to attend the Fisk Infrared Spectroscopy Institute at Nashville, Tennessee.

Dr. Jack L. Beal, Ohio State University, has received a $14,892 grant from NIH to make a phytochemical study over a two year period of plant material that exhibits antitumor activity.

The University of Washington College of Pharmacy has been awarded $13,691 in research grants from the Initiative 171 Fund. Projects under the terms of these grants will be supervised by Drs. Lynn Brady, Roy Hammarlund, Alain Huitric, Walter McCarthy, and Elmer Plein.

A one-year U.S. Public Health contract totaling $46,526 has been awarded to Dr. Mary Caldwell and Dr. Jack Cole of the University of Arizona to supply plant extracts to the cancer chemotherapy screening center.

The University of Minnesota College of Pharmacy has received a three-year grant of $39,000 from the National Institutes of Health for "Phytochemical Investigation of Certain Digitalis Species." Dr. Ole Gisvold is project director with Dr. Ayhan Ulubelen as principal investigator.

Several faculty members of the Rutgers College of Pharmacy have recently received research grants. They include: (1) Professor Clarence A. Discher—a grant of $7,000 from the National Institutes of Health for the purpose of continuing his studies of the photodegradation of pharmaceuticals. (2) Professor Marie T. Spoerlein—a grant of $2,000 from the Rutgers Research Council for continuation of her studies of a naturally occurring psychotomimetic agent. (3) Professor Augustus E. DeMaggio—a grant of $3,160 from the Rutgers Research Council for continuation of his tissue culture studies of fern embryos. (4) Professor Nicholas Lordi—a grant of $1,000 from the Rutgers Research Council for the construction of an analog computer for programming instrumentation.

Dr. Manfred E. Wolff, University of California School of Pharmacy, has been awarded a grant by the Smith Kline & French Foundation to carry out his research. He also received a grant from the National Institutes of Health for his research on "Steroid Hormone Analogs."

Book Reviews

Jean Brachet and A. E. Mirsky, Editors
The Cell, Volume IV
New York: Academic Press, 1960. xv + 511 pp., 159 figs., 18 tbls. $18.00.

The fourth volume of *The Cell* upholds the high standards of excellence which have been set by previous volumes. *The Cell* is complete in five volumes and covers the biochemistry, physiology, and morphology of cells. Each volume contains a general table of contents for the other volumes of this series along with a detailed table of contents for the individual volume. Each chapter begins with a complete index of the subject matter covered therein. In an effort to give the reader the latest information available, many chapters contain notes and postscripts of references which were added after the text was prepared. Each volume also contains a complete subject and author index. Approximately 1,841 references are given in Volume Four. This gives some indication of the thoroughness with which the topics are reviewed and documented. The large number of illustrations, time lapse photographs, phase contrast and electron micrographs greatly enhance the value of this book.

Volume Four is Part I of a two-volume series on specialized cells. Part II is found in Volume Five. Volume Four is devoted primarily to animal cells with only passing references to plants. The various chapters were written by leading authorities in their respective fields.

Chapter I, titled Viruses, discusses their properties, reproduction and infectivity.

Chapter 2 presents a thorough coverage of the visible organization of bacteria. This topic is covered according to the general features of bacteria, the cell wall, L-forms of bacteria, capsules, flagella, motile nonflagellated bacteria, spirochetes, plasma membrane and cytoplasm, the nuclei of bacteria, spores, and mechanisms of gene transfer.

Chapter 3, concerned with protozoa, discusses cell structures and their interrelations and cellular variations and their bases.

Intracellular parasitism and symbiosis are discussed in Chapter 4. This topic is covered as follows: kinds of intracellular parasites, methods of entry into the host cell and their relation to host-parasite specificity, intracellular habitat, temperature and intracellular parasitism, reproduction, escape from the host cell, effects on the host cell.

Chapter 5 deals with the neuron. The cytophysiology of the neuron, regeneration of peripheral neurons, aging processes in the neuron, and thoughts on an intracellular mechanism serving memory are presented.

Chapter 6 is restricted to visual photoreceptor structures. Photoreceptor structure, visual pigments, and photoreceptor physiology are discussed in some detail.

Chapter 7 is devoted to muscle cells. The major topics include: muscle proteins, their structure, reactions, and behavior in muscle; the mechanical and thermal properties of striated muscle and their mechanism of contraction.

Volume Four of *The Cell* and its companion volumes are excellent review and reference books and are highly recommended. This volume and this series should be available in all pharmacy libraries and in any library related to the biological and medical sciences.

Samuel T. Coker
Auburn University

C. P. Stewart and A. Stolman, Editors
Toxicology, Mechanisms and Analytical Methods, Volume I
New York: Academic Press, 1960. xvii + 774 pp., 94 figs., 53 tbls. $22.00.

In a foreword to this toxicology work, Dr. Alan Moritz points up the demands on toxicology created during recent years by the emergence of problems such as air contamination, increased incidence of home poisoning, and sub-clinical industrial poisoning. The need for more effectiveness and organization in programs of toxicological analysis is recognized in the preparation of this first of a two-volume treatise on toxicology. The object of the editors in presenting this work is to ". . . supply an account of general methods of analysis available to the toxicologist along with a discussion of principles in which they are based and a survey of the material to which they are to be applied." The result of the collaborated

efforts of a number of distinguished toxicologists and analysts, as indicated by this first volume, is a toxicology work of great import to the practicing toxicologist and all those concerned directly or indirectly with poisons. Probably no book in recent years deals more effectively with the duties and responsibilities of the toxicologist and his peculiar problems and their solutions.

In an introductory unit there is a general consideration of the work of the toxicologist and its relationship to other areas. There is a constant emphasis on the unique position of the toxicologist as a chemical analyst with the many biological and other variables to be considered in interpretation of his data. Also in the introductory unit there is a consideration of such very practical matters as report writing and evidence presentation.

Part I, comprising the next four chapters, considers the absorption, distribution, excretion and metabolism of toxic agents since, as the editors point out, the toxicologist must know what to look for, where and when his search may be successful, and how his results are to be interpreted with respect to amount of poison administered and the time and route of administration. This information on each potentially toxic agent, while not complete pharmacologically, does supply the facts pertinent to a toxicological investigation.

Part II, the remainder of Volume I, devotes eleven chapters to procedures of extraction, separation, identification and quantitation. This section begins with a systematic search outline and a chapter on isolation and separation.

The other nine chapters consider the adaptation to toxicological procedure of the most recent advances in instrumental methods of analysis. Included, among others, are chromatography, electrophoresis, counter-current distribution, x-ray diffraction, and micro diffusion. Each procedure is presented by an analyst experienced in use of the technique and also familiar with the problems peculiar to toxicology. Principles are covered along with detailed procedures for specific examples. These, along with a very adequate bibliography, should make the book a very useful one for a toxicologist attempting one of the analyses for the first time.

Although designed for the toxicologist and intended to serve its most important function in that area, its scope is sufficiently broad as to make it useful in many related fields. The exhaustive bibliography alone is a significant contribution.

B. B. Williams
Auburn University

Engelbert Broda
Radioactive Isotopes in Biochemistry
Princeton, New Jersey: D. Van Nostrand Company, Inc., 1960. x + 376 pp., 30 figs., 12 tbls. $11.50.

During the past thirty years the use of isotopic tracers in biochemistry has developed from a modest beginning to a tremendously broad field including almost all types of physiological and biochemical investigations. A rapid expansion in tracer techniques followed the isolation of heavy hydrogen by Urey, the development of procedures for enriching various stable isotopes, the building of machines by Crockroft and Lawrence for transmutation of elements, and the discovery of artificial radioactivity by Joliot and I. Curie. These developments led quickly to an extension of isotopic methods from the heavy (physiologically unimportant) elements to the lighter elements, many of which play prominent roles in biological processes.

The tremendous scope of contemporary biochemistry involving isotopic methods excludes the possibility of adequately presenting recent developments within a single volume. The author considers it his task here to introduce the reader to the methodology of biochemical work with labeled atoms. This is done with examples carefully selected from the principal fields of biochemistry with no attempt to delve deeply in any particular direction. Beyond these limits the specialist is appropriately left to read for himself the literature concerning his own subject.

Within this small volume Professor Broda has done a concise and masterful job of presenting the core of current knowledge pertaining to isotopic methods applicable in biochemical and pharmaceutical research.

The astounding increase in publications in this field makes the writing of such a book an almost impossible task. Approximately 3,700 literature citations are given for the year 1958.

This book is an English translation by Dr. Peter Oesper of the German edition titled *Radioaktive Isotope in der Biochemie*, published in 1958 by Franz Deuticke of Vienna. The first seven chapters are concerned with the principles of radiochemistry, radiosynthesis, isotopic effects, radiation biology, and protection against radiation. Chapters 8 and 9 provide a thorough coverage of methods and instrumentation used in the measurement of radioactivity and its application in the analysis of living matter. Absorption, excretion, and membrane transport of radioactive substances are discussed in the following chapter. Chapters 11 through 15 are devoted

to discussion in sequence of the application of tracer techniques to phosphorylations and photosynthesis and to studies on the intermediary metabolism of carbohydrates, fats, proteins, and nucleic acids. The final chapter covers a series of special topics concerning the intermediary metabolism of antigens, antibodies, heme, cholesterol, lignin, and foreign toxic substances.

In the reviewer's opinion this book qualifies as an excellent reference text for students of biochemistry and pharmacy who are learning to work with labeled atoms. Also, those engaged in research in these or related fields will find this book one of the best sources of basic procedures and principles of isotopic techniques.

John R. Clopton
University of Colorado

Steward, F. C., Editor
Plant Physiology, Volume 1B: Photosynthesis and Chemosynthesis
New York: Academic Press, 1960. xvii + 348 pp., 130 figs., 31 tbls. $12.00.

Although physically a separate entity (with its own table of contents, index, and separate pagination), this book and volume 1A (which deals with cellular organization and respiration) are intended by the authors, editor, and publisher to be considered as a single unit in the over-all plan of the six-volume treatise on plant physiology. To emphasize the idea that volumes 1A and 1B are really two parts of the same volume, the two chapters comprising the present book are numbered 4 and 5, in other words consecutively with the three chapters of volume 1A which preceded it.

The two chapters of volume 1B "deal with the questions which surround the acquisition of energy by plants and its storage in ultimately usable chemical forms." Chapter 4, which is concerned with photosynthesis, was prepared by Hans Gaffron and accounts for the major portion (277 pages) of the book. Chapter 5, on chemosynthesis, was written by Martin Gibbs and Jerome Schiff.

The chapter on photosynthesis considers in sequence the structure and constituents of chloroplasts; chemistry and photochemistry of the chlorophyll molecule *in vitro;* influence of external factors on the rate of photosynthesis; absorption, fluorescence, and luminescence in living cells; photosynthesis in flashing light and the photosynthetic unit; the storage of energy and the efficiency of photosynthesis; fixation and reduction of carbon dioxide; carbon assimilation in purple and green bacteria; hydrogenases in bacteria and adapted algae; photosynthesis with cell extracts; energy transfer by active phosphate in photosynthesis; effect of poisons; and transient effects or induction periods. It concludes with an interesting section on obsolete or useless hypotheses and current problems.

Chapter 5 (Chemosynthesis: The Energy Relations of Chemoautotrophic Organisms), after a brief introduction, deals with thermodynamic considerations; chemical transformations in the assimilation of sulfur and nitrogen; chemosynthesis in nitrifying bacteria, nonphotosynthetic (colorless) sulfur bacteria, and hydrogen bacteria; efficiency of chemoautotrophic bacteria; an hypothesis to explain chemoautotrophic growth; and conclusions.

The authors of both chapters have handled their subject matter with thoroughness and meticulous care, keen insight, and imagination. The presentation of their complicated subject matter is lucid and direct. The abundant use of well-chosen diagrams and graphs is very helpful.

The proposed six-volume treatise, of which volumes 1A and 1B and 2 have been published to date, "is intended not solely for use as a work of reference, but is to be read by those who wish to obtain a reasoned analysis of the status and development of each subject which is discussed." The objective of the editor and publisher has been successfully achieved in the volumes thus far released, although it is likely that the primary use of the books will be as reference volumes. Their value for this purpose is enhanced by the extensive bibliographies and good indexes.

Certainly those teachers of pharmacognosy who are concerned with fundamental energetics at the cellular level will want to have the present volume, and it should be in the library of any school of pharmacy where basic biologic research is encouraged.

Robertson Pratt
University of California

Leonard Engel
Medicine Makers of Kalamazoo
New York: McGraw-Hill Book Company, Inc., 1960. vii + 261 pp., 4 plates. $4.50.

Virtually anyone with some pharmaceutical interest would probably find Mr. Engel's account of the early history, development and growth of one of our largest drug companies a fascinating and thoroughly enjoyable reading experience. The book is written in layman's language and is designed for mass sale to the general public. It is not a technical text. The book has been favorably reviewed previously in such mass circulated periodicals as *Time* magazine. The appearance of this book on the market is very timely, from the

standpoint that it describes the difficulties of a major drug company today in profitably bringing new pharmaceuticals to market, at a time when widespread unfavorable publicity has dropped the industry to perhaps its lowest public prestige level. The fact that the drug industry has attracted a very great deal of attention in recent years, ranging from exaggerated praise to exaggerated criticism, is justification for a book of this kind.

Medicine Makers of Kalamazoo is primarily a biographical account of the life history of the Upjohn Company. The book describes contributions of other pharmaceutical companies, however, as the stories of some of the more notable chemotherapeutic breakthroughs are unfolded. The fact that the book is at least in part a history of the whole American pharmaceutical industry, adds materially to its interest and possible value as a teaching tool. Since other of our major drug companies had a very similar origin to that of the Upjohn Company (physicians or physician-pharmacists who were discontented with the state of therapeutics seventy-five to a little over one hundred years ago) and were enterprises which developed initially as family rather than corporate businesses, the Upjohn Company biography really describes in general the early development of the pharmaceutical industry in this country. Trends in medical practice, federal acts of legislation, and other factors which influenced the development of Upjohn and the industry are clearly defined.

The early history of the Upjohn Company as influenced by the state of development of pharmacy and medicine and the personalities of the founding Upjohn brothers results in delightful and frequently humorous reading. Mr. Engel has made the narration of the life of a company nearly human by including some of the company's more notable misadventures and embarrassments; discoveries that came a few weeks too late, patent problems, crash programs that crashed, or the goose-chase to Africa for the lost strophanthus. The development of classes of chemotherapeutic agents which are narrated includes vitamins, hormones, cortisone and subsequent steroids, antidiabetic drugs, and antibiotics, among others. The stepwise discoveries of the major contributors in each of the areas developed above are given, together with their company or institutional affiliation. The advances made in the Upjohn laboratories are, of course, emphasized. The details of the development of such successful Upjohn products as the friable pill, Phenolax, Citrocarbonate, Gelfoam, Albamycin, Medrol, and Orinase are told. Chapters are also included on such topics as the accomplishments of medicine, modern pharmaceutical research, clinical testing, pharmaceutical engineering, sales, etc.

The author, with a background in scientific and medical journalism, has done a good, factual, though sometimes rather sentimental, job of presenting a history of one drug company with implications to the pharmaceutical industry as a whole. This is the first book of its kind and should have a place on the library shelf of every school of pharmacy. Portions of the book could be useful both in a pharmacy orientation and a manufacturing pharmacy course. The book is further recommended to readers of this review for their simple reading enjoyment.

Gilbert S. Banker
Purdue University

Francis M. Forster, Editor
Evaluation of Drug Therapy
Madison, Wisconsin: The University of Wisconsin Press, 1961. xxiv + 167 pp. $4.00.

Evaluation of Drug Therapy is not truly a text. It is the proceedings of the first symposium on Evaluation of Drug Therapy in Neurologic and Sensory Diseases held at the University of Wisconsin, May, 1960. The symposium was designed specifically to consider problems in the field of neurologic and sensory diseases with the fundamental aim of improving the quality of clinical evaluation of drugs in these fields.

The book is divided into three sections. The first section, titled Pharmacologic Aspects of Testing, consists of three papers delivered by a pharmacologist, by a representative of the pharmaceutical industry, and by an official of the Food and Drug Administration. These papers discuss the pharmacologic problems in evolving new drugs in the field of neurologic and sensory diseases, such as structure-activity problems and problems of animal screening. The progress of a new drug through the testing process as followed in the pharmaceutical industry is also described. Finally, the problems faced by the Food and Drug Administration in evaluating new drug applications are reviewed. The second section consists of three papers presented by biostatisticians and deals with some of the methodological principles involved in clinical trials. The final section consists of eight panel reports produced by panel groups in the areas of epilepsy, vertigo, neuralgias, headache, glaucoma, multiple sclerosis, diseases of the muscles, and Parkinsonism. These groups were charged with the responsibility of defining their disease entities in

accurate terms which would be recognizable to all, to define improvement in those disease areas, to agree on reliable methods for measuring that improvement, and if at all possible, to agree upon acceptable animal screens for each disease entity.

Although designed specifically to consider problems in the field of neurologic and sensory diseases, parts one and two of the book, the pharmacologic and statistical approach to the problems of drug development and testing, are broad enough to be applicable to all medical fields. These sections should be of general interest to pharmacy students since they do present a broad picture of the problems involved in drug development and testing. The third section of the book deals with specific neurologic and sensory diseases but should enable one to appreciate some of the difficulties involved in designing a meaningful testing program for evaluating new drugs. I would recommend this book for addition to a pharmacy library. However, it is not suitable as a text or as a reference work for specific areas.

Seymour M. Blaug
State University of Iowa

Charles Herbert Best, Norman Burke Taylor, et al.
The Physiological Basis of Medical Practice.
Seventh Edition
Baltimore: The Williams & Wilkins Company, 1961. xvi + 1554 pp., 657 figs., tbls., 4 color plates. $16.00.

In an effort to obtain authoritative coverage, the latest edition of this standard text has been produced under multiple authorship, and there are no less than thirty contributors, including the two original authors. Such a division of labor too often yields very uneven results, with a variety of styles and approaches and marked differences in completeness of coverage in different parts. To an unusual extent, this has been avoided here, probably in part because one of the original authors has served as general editor, and also because the original organization of the book, with both its faults and its virtues, is still closely followed. The section headings, The Blood and Lymph, Circulation, Respiration, The Excretion of Urine, Digestion, Metabolism and Nutrition, The Ductless Glands or Endocrines, The Nervous System, The Special Senses, remain the same as in previous editions, and this is also true of a majority, though by no means all, of the individual chapter headings. Nevertheless, every chapter has been revised or rewritten to a greater or lesser extent, and it is undoubtedly true, as the authors state, that this is the most comprehensive and authoritative edition since the inception of the book. It is also the greatest in weight and bulk, with some two hundred more pages than the edition that preceded it. The most complete rewriting has been done in the sections on circulation and respiration, and in parts of the section on the special senses.

The type faces have been improved so as to make for easier reading. Pertinent references, formerly all grouped at the end of the book, are now placed at the end of each chapter, in closer relationship to the topics discussed. New references have been added to bring the listings more nearly up to date, but, especially in some sections, many references to older literature have been dropped. There is a very complete index in which pages devoted to major discussions are indicated by boldface type.

Intended for students in medicine, this book lives up to its title in that it definitely links physiology to medical practice. It is not a textbook of pathological physiology; basic physiology comes first, and the coverage of many topics is as complete as can be found in any textbook. It does, however, tend to emphasize those aspects of the subject that are likely to be helpful in understanding disorders of function, and greater space is given to matters of abnormal physiology than would be the case in a text intended for more general use. Also, topics that might be treated separately at some length in texts intended for general use may here be found to have received somewhat parenthetical or incidental mention. There is, for example, no general discussion of cellular physiology, or of bioelectric potentials, although the latter necessarily get some attention in connection with the heart and with the nervous system. The physiology of muscle is treated chiefly in connection with metabolism and nutrition, with scattered references elsewhere, and is one of the least satisfactory parts of the book. Reproduction, though rather well covered, is treated as a subtopic of the endocrine glands.

This is certainly not a text to be used in courses for undergraduate students of pharmacy, and even graduate students would probably find a great deal of the material of little concern to them. They might also find some of it rather heavy going, as medical students often do. The book could, however, be valuable as a reference work, and it might well be made accessible in pharmacy libraries for that reason.

R. N. Danielson
Medical College of South Carolina

Ralph Lee Smith
The Health Hucksters
New York: Thomas Y. Crowell Co., 1960. 248 pp. $3.95.

The Health Hucksters, "a story without heroes," is based upon Mr. Smith's belief that "nearly everyone has played the public false." The greater portion of the book (Chapters 2 through 11) is devoted to demonstrating the "falsifying or distortion of medical truth for commercial profit." In lengthy, Sunday-supplement-type dissertations on vitamins, dentifrices and cold cures, obesity, cholesterol, ethical drugs, arthritis, cigarette ads, food fads, and cosmetics, examples are given of the false and exaggerated advertising claims for the commodities in each group. Most of these items and/or their advertising have been the object of legal actions by the FDA, the FTC, or the Post Office Department. In his two closing chapters, the author discusses "Modern Advertising vs. Horse-and-Buggy Law" and "Needed: A Consumer's Bill of Rights." Here he delineates, and quite accurately, the cumbersome, inadequate, and conflicting enforcement procedures of the government agencies, and pleads that the FTC be granted "injunctive powers over all false and misleading medical, cosmetic, and tobacco advertising." For long-range control he suggests a new agency, the "Federal Advertising Commission," and a new federal post, that of "Consumer Counsel to the President." These reforms are desperately needed, Mr. Smith feels, to "protect the consumer."

The author succeeds in giving his opinions on a variety of topics which he relates to this immediate problem, including fair trade, generic names, rigged TV shows, payola, postal subsidies, and the FCC. Some of the Kefauver committee evidence is quoted in the chapter on ethical drugs, and the Blatnick committee is referred to frequently. The retail pharmacist, when mentioned, is pictured as a protesting pawn in the marketing schemes of the PMA, and the bulk of the blame for the whole huckstering mess is placed upon the advertising agencies and the downhill slide of advertising ethics.

This book fails to be a significant contribution to literature or a clarion call to social action for several reasons. First, Mr. Smith in his presentation appears to be less an angry young man than a tired, disillusioned copywriter for his former employer, the National Better Business Bureau. Second, in his choice of examples he shows little discrimination between the chronic mail fraud promoter and the more legitimate drug manufacturer. An overly long discussion of the defunct Seaboard Drug Company, used as an example of a fraudulent drug promotion combined with a stock swindle, creates the general impression that this is about par for the industry and that perhaps Dr. Parke should keep his eye on Mr. Davis or that Klein may be stealing from Smith and French. Third, no historical orientation to the whole "patent medicine" or "big advertising" situation is provided; judging from the book, huckstering is something left over from the Eisenhower administration and its "euphoric atmosphere of a 'businessman's government'." *The Health Hucksters* may some day be of interest as a reflection of the confused, myopic, and committee-inspired outbursts of moral indignation which flared in the latter part of the twentieth century. For the moment, its popularity will be limited to organizations of retired persons or consumers' clubs. It should be read aloud to such groups, for it would gain much from the spontaneous verbal punctuations of a reacting crowd. Its absence from any library collection would scarcely be noticed.

Edward S. Brady
University of Southern California

A. L. Copley and G. Stainsby, Editors
Flow Properties of Blood and Other Biological Systems
New York: Pergamon Press, Inc., 1960. xviii + 446 pp., figs., tbls., plates. $12.50.

The book contains forty chapters by forty-eight authors which were the proceedings of an informal discussion jointly convened by The Faraday Society and The British Society of Rheology in September, 1959. As is true with all multi-author books, the reader must adapt himself to the style and presentation level of the individual authors from chapter to chapter. The book is divided into five parts as follows: General Lecture, Haemorheology, Systems Other Than Blood, Demonstrations, and Exhibits and Scientific Films.

The breadth of the general subject of the rheology of biological systems is wide. This is illustrated by citing a few chapter titles, such as "Mechanical Properties of Fish and Fish Products in Relation to Eating Quality," "The Velocity Profiles of Pulsatile Blood Flow," or "The Consistency of Human Cervical Mucus and its Dependence on Hormonal Factor." Most, if not all, chapters strike the reviewer as being authoritative.

The book should serve as a good reference work for pharmaceutical scientists and teachers in schools of pharmacy not only for the subjects covered, but also for the bibliographies at the end of each chapter.

The general introductory lecture which is

the first part of the book is mainly concerned with concentrated polymer solutions. Good theoretical treatment in the second part is given on the subjects of the anomalous viscosity of blood and differential flow velocities of plasma and corpuscles in living bodies. Some of the information in the chapter on eating quality of fish in relation to the mechanical properties of either the fish themselves or of their products, which is included in the third part, is applicable to pharmaceutical formulation.

In the fourth part of the book, a brief discussion on demonstrations on applications of rheology which might be of use to the teachers of pharmacy is shown. For example, simple demonstrations to show the rheological behavior of visco-elastic and visco-inelastic liquids is described.

Also in the fourth part are included descriptions of special pieces of apparatus for rheological measurements: For example, a wall adherence apparatus, a rolling ball viscometer made from a Liebig condenser, and a consistometer, among other things. These instruments, of course, have applications in pharmaceutical as well as biological systems.

In the last part of the book, descriptions of eight scientific films are given, most of which are deposited in the Wellcome Foundation Film Library in London.

Eino Nelson
University of California

James B. Allison and William H. Fitzpatrick
Dietary Proteins in Health and Disease
Springfield, Illinois: Charles C Thomas, 1960. viii + 86 pp., 12 figs., 5 tbls. $4.50.

This is a part of a series called *American Lectures in Living Chemistry*, edited by I. N. Kugelmass and "designed to advance our newer knowledge of chemical medicine in the cause of clinical practice." The major sections of the book are as follows: Basic Concepts, Digestion, Nitrogen Balance, Proteins and Growth, Proteins and Maintenance, Calories and Proteins, Nutritive Value and Problems in Supplementation, and Plasma and Liver Proteins. This would seem to be a timely addition to the series, since protein deficiencies constitute one of the most important public health problems in the world today. This slim volume should be a useful introduction to the literature in the field since it is essentially a unified review, with many references to original work. It should not be regarded as a reference book in itself, since it is too short to consider any one topic in detail. The style of the monograph is clear, and the diagrams seem generally well chosen to illuminate the presentation. In the few areas covered in which this reviewer has any specialized knowledge, the discussion and choice of references seemed competent.

The first section, on basic concepts, deals with nine major research areas such as protein synthesis and specific amino acid deficiencies, by way of introduction to the clinical discussions. Since less than a page each is devoted to most of these, the section probably would not be illuminating to someone really unfamiliar with the areas. It might, however, be useful as a "memory refresher." Concerned as it is with clinical problems, this book would be of little use to workers in the basic sciences. It can be recommended for its specialized purpose.

Harold D. Swanson
Drake University

Marcel Florkin
Unity and Diversity in Biochemistry
New York: Pergamon Press, Inc., 1960. xiii + 397 pp., 104 figs., 24 tbls. $10.00.

This book is a translation from the original French edition. The date of original publication is not given, but the translator's preface states that the original text has been altered and added to to keep it up to date. The author has written other books and edited journals in the field of comparative biochemistry and should be well qualified. This is Volume I of a series called *Modern Trends in Physiological Science* edited by P. Alexander and Z. M. Bacq. The author states that his book is "neither a treatise nor a textbook on biochemistry, but a number of essays grouped around ideas of the unity and diversity of organisms in the biochemical sphere." The first section, comprising about a third of the book, is a catalog and general description of important biochemicals, with a wealth of structural formulas showing various representatives of each class of compounds. Part two is on enzymes and biochemical energetics. The third part, titled "Chemical Reactions in the Biosphere," deals with intermediary metabolism and biosynthesis. This is followed by a short section on "Topobiochemistry and Cellular Regulation." Part Five, probably the most important section of the book, begins with a description of the diversity of terpenes, porphyrins, and proteins, briefly considers the "Inheritance of Biochemical Characteristics," and considers the importance of biochemical diversity to taxonomy and evolution. The final section, called "The Metabolism of the Biosphere," is concerned with nutrient cycles

in ecology and the role of specific kinds of organisms in these.

Despite the author's disclaimer, the book's jacket says, "This book is suitable for students and teachers of courses of general biochemistry and biology." However, it is difficult to think of a biochemistry class for which it would be suitable. The fact that the major part of the book is devoted to general biological problems would seem to make it unsuitable for the special needs of students of medicine or pharmacy. It seems likely that the opening descriptive section was included to make the book suitable for a text. But in the attempt not to leave anything out, this section seems to have become too compressed and difficult for most undergraduate courses in biochemistry. The book's general orientation would seem to suit it best to graduate students in biology, but here its usefulness is limited by the practice, as in undergraduate texts, of giving few references to original work in the body of the discussion. Each chapter is followed by a list of appropriate reviews and monographs, but it would often be exceedingly difficult to locate the source of a fact or hypothesis.

This is a stimulating book to a biologist. Also, the writing is clear and the translation not obvious. Despite its limitations, this book would be a useful addition to the library of anyone interested in biochemistry in its broader implications. The book is not inexpensive, and it may be unfortunate that the last two sections, which deal with the applications of biochemistry to fields of biology not always closely allied to it, were not published by themselves.

Harold D. Swanson
Drake University

A. R. Pinder
The Chemistry of the Terpenes
New York: John Wiley & Sons, Inc., 1960. vii + 223 pp., 3 figs., 4 tbls. $8.25.

This volume is intended to bridge the gap between the numerous books on organic chemistry and the comprehensive treatises on terpenes such as that of Simonsen. This has been done quite well.

The general analysis of essential oils for their constituents is covered briefly. Then the usual methods, both chemical and physicochemical, for the determination of structure are discussed more extensively.

Most of the book includes the various terpenes and polyterpenes arranged systematically according to their increasing complexity. For each of the compounds is given some information on its sources and uses with a large proportion of each monograph devoted to proof of structure, by degradation and by synthesis, with the help of physicochemical data and the isoprene rule.

All the common monoterpenes are taken up in the first third of this volume in detail sufficient to please all but the specialist. The chapter on sesquiterpenes is extensive and indicates an apparently greater interest on the part of the author. The portion on diterpenes gives due attention to the structures of vitamin A and the resin acids. Among the triterpenes, squalene, lanosterol, and the amyrins are suitably emphasized. The relation of squalene and lanosterol to the steroids is pointed out. The chapter on tetraterpenes or carotenoids is relatively brief from the standpoint of the specialist but not when the scope of the book is considered.

The concluding chapter on biogenesis of terpenes discusses the importance of the isoprene rule but indicates that this hypothesis is probably an extension of the more fundamental rule that the repeating unit is acetic acid.

This work cannot be used as a laboratory manual for volatile oil analysis as can some parts of Guenther's work; neither does it have the space to discuss the economic aspects of essential oil production.

Pinder's volume is excellent as assigned reading for the undergraduate in pharmaceutical chemistry and as a text in graduate work when only a portion of a semester is allowed for terpenes. For a more thorough course this book could serve as a basic text to be supplemented by original papers.

The author presents his material simply but still thoroughly. The references are good, and many structural formulas illustrate the reactions discussed.

Carl H. Johnson
University of Florida

S. Lewin
The Solubility Product Principle
New York: Interscience Publishers, 1960. xvii + 115 pp., 2 tbls. $3.50.

In this book the author has reconsidered the various aspects of the solubility product principle as applied to ionic precipitations and solubilities. He first derives the reduced solubility product in terms of anhydrous ions, as is usually done in the standard textbooks. A comprehensive activity solubility product is then derived and subsequently used when applicable in later chapters. The eight short chapters which follow consider in turn the various factors which affect the use and application of the solubility product principle in

analysis. The points made in each discussion are well substantiated with pertinent experimental data. Sources are given in all cases.

In the appendix the author briefly considers various background topics (i.e., ionic strength, dipole moment) necessary for an adequate understanding of his discussion, gives a table of solubility products, and an extensive bibliography. The appendix also has a section giving sample calculations and fourteen typical problems for solution by the reader.

The book is well written and nicely organized. In some cases the topics could possibly have been covered in greater detail. The author succeeds in his purpose of contributing to a better understanding of the proper use and the limitations of the solubility product principle. He accomplishes this by focussing attention on those factors affecting solubility product calculations and applications which are usually considered only in a positive sense or completely neglected in the usual elementary or intermediate level courses in qualitative analysis.

This book makes available to the teacher of analytical courses a single concise reference devoted to the solubility product principle. By using it in qualitative analysis as a supplemental textbook or as a reference available in the library, the instructor can circumvent the usual time limitations which prevent a thorough presentation of this important principle.

Clarence A. Discher
Rutgers—The State University

A. J. Swallow
Radiation Chemistry of Organic Compounds
New York: Pergamon Press, Inc., 1960. xiii + 380 pp., 40 figs., 73 tbls. $15.00.

Radiation chemistry is concerned with the chemical changes produced by high-energy radiation, and the mechanisms by which they occur. This is a subject about which much speculation has been and is being made, but the main outlines of the subject are emerging and, for such a recent science, much definite information is known. Well over two hundred papers per year are now being published in this field, and there is definite need for a book of this nature. Actually, this book is the second in a series of monographs devoted to *Radiation Effects in Materials*, the first covering radiation effects on polymers, and the first to give an over-all picture of these effects on organic compounds. The literature to the middle of 1958 has been exhaustively covered, and gaps in our knowledge are pointed out as well.

The volume is exceptionally well organized. It includes, after a general introduction on net chemical effects produced by radiation, mechanisms of the interaction of high-energy radiations with matter, and transient entities formed by radiation, chapters on Experimental Methods, Water and Aqueous Systems, Aliphatic Compounds, Aromatic Compounds, Polymers, Dyestuffs, Some Substances of Biological Interest, and Radiation Chemistry and Other Fields. The latter chapter includes short but definitive descriptions of the role of high-energy radiation in the study of the history of the earth, radiobiology and radiotherapeutics, determination of molecular size, sterilization of pharmaceutical products and foods, and other economic aspects. There is a short summary at the end of each chapter which many will find useful, as well as a closing chapter of conclusions regarding the present state of knowledge of this field.

The text is well written, presenting accurate descriptions of detailed and complex material (to the usual variants in chemical reactions are added those involving type and source of radiation, dose, dose-rate, and linear energy transfer) in precise and narrow terms. The reader unacquainted with this field will, however, find it easy to follow with only a minimum knowledge of radiochemistry, chemical kinetics, and free radical chemistry, with which this subject is closely linked. A large number of tables and figures illustrate the material effectively, and chemical formulas and equations are generously employed. No fault can be found with the mechanical aspects of the printing (with the exception that a repetition of the structure of ascorbic acid on p. 230 seems wholly unnecessary). Readers with biological and pharmaceutical interests will find much of importance in the chapter on substances of biological interest. The book is addressed to the general reader, but will serve as a rather complete reference work for the specialist as well and will probably shape the direction of much research and the form of future books in this field.

William O. Foye
Massachusetts College of Pharmacy

John Field, Editor-in-Chief
Handbook of Physiology, Section 1: Neurophysiology, Volume III
Baltimore: The Williams & Wilkins Company, 1960. 572 pps., 122 figs., 25 tbls. $20.00.

This is the third of a contemplated multivolume *Handbook of Physiology* and marks the completion of Section 1 titled "Neuro-

physiology." Each chapter of this volume, as of the two preceding volumes on neurophysiology, is written by scientists who have distinguished themselves in the area which they review and represents a comprehensive survey of the experimental findings and concepts which constitute the present-day status of the subject.

This volume includes twenty-three chapters written by twenty-seven authors. The subject matter is divided into four groups: neurophysiological basis of the higher functions of the nervous system, the central nervous system circulation, fluids and barriers, and neural metabolism and functions. The first section, introduced by Dr. Wilder Penfield, includes discussions on sensory discrimination, learning, motivation, emotional behavior, sleep and wakefulness, perception, memory, speech, and psychosomatics; the second section, introduced by Dr. Carl F. Schmidt, includes chapters on cerebral circulation and on intracranial and intraocular fluids; the third section, introduced by Sir Rudolph A. Peters, includes chemistry, metabolism, and function of the central nervous system and its major components. The last chapter, written by Dr. R. W. Gerard, is a scholarly integration of molecules, neurons, and behavior. In addition, this, the final volume of Section 1, contains both an author and a subject index to Volumes I, II, and III.

It is recognized that the integration of a series of monographs into a single volume the size of this one represents a herculean editorial task. Nevertheless, this reviewer feels a more stringent editorial policy would have improved this excellent work. For example, some chapters carry the reader along with occasional summary paragraphs, whereas others omit any summary or concluding statement. The value of this book as a reference would have been enhanced if the tables and figures had been numbered consecutively within each volume or if a list of the tables and figures had been included in the index.

This is a high-level presentation addressed primarily to interested individuals with a considerable background in physiology who want to raise their understanding of modern neurophysiology to that necessary for predoctoral study, for teaching, and for research. In general, it is easy to read and is written in a clear, concise fashion. It is not intended as a textbook and will probably have little attraction for the undergraduate pharmacy student. It should prove a valuable reference for graduate students and teachers in pharmacology and physiology. Research workers in psychology, psychopharmacology, and neurophysiology will find it especially useful. This valuable reference should be in every pharmacy and medical library.

Ewart A. Swinyard
University of Utah

Martin S. Peterson
Scientific Thinking and Scientific Writing
New York: Reinhold Publishing Corporation, 1961. vii + 211 pp., 8 figs., 13 tbls. $6.95.

Graduate study in the pharmaceutical sciences, as in the other professions and sciences, is today all too often conducted on a sink-or-swim basis. The unsuspecting student is plunged into his course work, assigned a research topic, and left to his own devices to design his experiments, collect his data, interpret them, and write them up. He is expected to develop, by some sort of academic osmosis, a feel for the scientific method and an ability to express his findings intelligibly to his colleagues in science. This book, while its thesis concerns the indestructible relationship between scientific thinking and scientific writing, can help to fill this gap in the training of young scientists.

The book should be required reading for every first-year graduate student in science. (A review of its concepts just prior to writing up the research would be in order too.) Dr. Peterson has drawn on his experiences as editor of *Food Technology* and *Food Research* to develop his ideas; his approach is novel in that he does not become involved with the mechanics of style; rather he correlates good expository writing with logical scientific thinking. In five clean-cut chapters, he provides a brief look at the scientific forest, admittedly leaving the trees to his readers for later, closer scrutiny. The unmistakable impression is that effective scientific writing is "rigorously logical."

Dr. Peterson begins where a writer would begin. "When an author sits down to write a journal article, his first task is to visualize and construct a logical pattern or design that he can follow. In general terms, the logical design that scientists customarily follow is: a clear and complete *statement of the problem*; a hypothesis based on deductive reasoning as the solution of the problem; *analysis*, utilizing inductive reasoning, of the experimental data; *generalization*." This statement is tied to the usual outline for a scientific paper: Introduction, Experimental, Discussion, Conclusions, References.

The statement also provides the setting for a discussion of general logic in the first chapter. Deduction and induction in Chapter Two become "two faces of a single coin," with the fundamental methods of inductive reasoning

listed as being highly pertinent to reliable analysis of data. (Although Dr. Peterson does not mention it, these are the methods given their classic formulation by John Stuart Mill.) The relationship of specific methods and techniques to the interpretation of data is the topic of the third chapter, since "competent scientific writing is primarily dependent on the ingenuity, the creativity, and the specialized knowledge of the scientist . . . Many special methods, though by no means all, are designed to isolate, characterize, and identify or measure the unknown. This basic pattern suggests the order in which a special method should be written up and, by extension, how the discussion should be organized." At the conclusion of each of these first three chapters, Dr. Peterson includes exemplary articles, selected for their ability to support his discussions. They do so admirably.

The last two chapters deal indirectly with the problem. Chapter Four discusses the need for the scientist to "professionalize" himself, to develop his professional background through association with his fellow scientists, with the adoption of an organized program of reading—made effective by recording and thinking about what he reads—and with a concentrated effort to understand the logical bases of observation, experimentation, and interpretation. This chapter ends with a short, annotated list of readings in what is called the "culture of science": orientation, historical perspective, logic and method of science, and the language of science. Finally, the fifth chapter is devoted to "type" specimens of communication: the scientific essay, the scientific talk, the book review, and the review article.

The strength of the book lies not only in its fulfillment of a need, but also in its style. It is direct, it is pointed, it is brief, and it practices what it preaches. Dr. Peterson has the ability to build immediate rapport with his readers. He develops his material logically, and he does not bury his ideas in detail. The book itself is a bird-in-the-hand model of highly qualified writing and thinking. Each chapter is introduced, developed, and summarized. The writing is lucid and informative, and the ideas are supported with well-chosen graphic material, handled with the expertness of a practiced writer and editor.

The excellent choice of his examples, together with the splendid use of the marginal comments alongside the model in Chapter Two, leads to a disappointment that the marginal notation technique was not used with all of the samples. In Chapter Five, each selection does have a "general analysis" and a "specific comment," but the personal comments in direct connection with the text would constitute better support for the ideas.

Along with being required reading for the beginning graduate student, this book should also be read by the major professors. Lacking that, it should certainly make the acquisition list of the college—and other scientific—libaries. Because of its general concern with the methods of scientific thinking and scientific writing, it should be placed on the shelves of the libraries of the colleges of pharmacy for the benefit alike of undergraduate and graduate students and of faculty. It is an unhappy thought that, unless the current direction of graduate study undergoes quite a change, the book is liable to remain there.

George E. Osborne
University of Rhode Island

Z. M. Bacq and P. Alexander
Fundamentals of Radiobiology
New York: Pergamon Press, Inc., 1961. xii + 555 pp., 176 figs., 42 tbls. $12.00.

This book accomplishes what the authors intended. In the Foreword, they state, "We have not aimed to provide a review for the specialists of individual topics, but have tried to present the subject as a coherent whole." The chief value of this book is that, for the first time, radiation biologists have at hand a critical treatment of the mechanism of action of radiation injury in biological material. Certainly this book does present a critical viewpoint concerning which are the most acceptable hypotheses of the mechanism of radiation injury. It is refreshing in this era of the "committee approach" to scientific problems to find authors who are not too timid to state what they believe the most likely to be true. How well the authors have succeeded in selecting the more attractive hypotheses is not now known exactly, but at this particular point in time they make a rather convincing case for their viewpoints.

The book proceeds from a consideration of the interaction of ionizing radiation with matter, including consideration of direct and indirect effects, the hit concept, macromolecular chemistry, and aqueous system chemistry, to a detailed consideration of how radiation-induced biochemical lesions may produce enzymatic, cellular, genetic, physiological, and pathological changes. Chapters concerned with procedures that either stimulate or protect against radiation effects contain information that complements the general plan of analyzing radiation effects from the molecular to the gross level. Comparative radiosensitivity, therapy procedures, and effects in man are also discussed. The only obvious lack of

coverage is in the field of radiation effects in plants. I find that the first half of the book, which deals with the more chemical aspects of radiation injury, is somewhat easier to read than the second half. The author index and subject index are adequate. The illustrations are well chosen as are the references, particularly since many of the older papers that have become classics are included. It is sometimes important for Americans to remember that not all of the scientific literature appears in United States journals. This is particularly true in the case of radiation biology as an examination of the some 1,600 references in this book will show. Fewer than half come from the United States, one-fifth are British, approximately 2 per cent are Russian, and the remainder come from other countries.

Whether or not there is a need for a separate discipline of radiation biology is being debated. This book would add weight to the side of the argument for the establishment of a new discipline. Since there are now some thirteen American universities offering a Ph.D. program in radiation biology, the continued advancement of radiation biology as a separate discipline will profit from this book as it might well be used as a textbook for a course in radiation biology.

I would recommend this book to anyone who wants to know what radiation biologists are up to, as well as to radiation biologists who want to find out what other radiation biologists are doing and thinking.

Claire J. Shellabarger
University of Michigan

J. H. Kenneth, Editor
Henderson's Dictionary of Scientific Terms. Seventh Edition
Princeton, New Jersey: D. Van Nostrand Company, Inc., 1960. xv + 595 pp. $12.50.

This standard scientific dictionary, first published in 1920, has now reached its Seventh Edition. Its purpose is still to convey the "pronunciation, derivation, and definition of terms in biology, botany, zoology, anatomy, cytology, genetics, embryology, physiology." In addition to this it includes two pages of equivalents (weights and measures) and six pages of abbreviations.

For the most part the dictionary succeeds admirably in its stated purpose. For this Seventh Edition Dr. Kenneth has added about 1,750 new terms and definitions; the total number of terms is now around 15,600.

There can be no quarrel with the concise and lucid indications of pronunciations and derivations. Most of the definitions are clear and simple enough for the average lay reader to comprehend. Sometimes, however, the definitions are too technical and involved for the layman, though not for those actively engaged in the fields covered by the dictionary.

The usefulness of *Henderson's Dictionary* to the student or active worker in the various fields of pharmacy is dubious. Out of a sample list of older and more modern terms used in pharmacy—belladonna, tranquilizer, equimolar, percutaneous, chemotherapeutic, psychopharmacology, chromotography, spectrophotometry, electrophoresis, comp[illegible]xation, surfactant, transistors, and half-life—this reviewer found only one term—electrophoresis—defined. Many of these terms are defined in modern college dictionaries.

Whatever its limitations for pharmacy students, *Henderson's Dictionary* remains a useful and necessary reference work for any scientific library. Perhaps, though, it does emphasize a genuine need for a separate and extensive dictionary of pharmacological terms.

William B. Bjornstad
Drake University

Charles N. Reilley, Editor
Advances in Analytical Chemistry and Instrumentation, Volume 1
New York: Interscience Publishers, Inc., 1960. vii + 445 pp., 32 figs., 31 tbls. $12.00.

This is the first of a planned annual series on analytical chemistry and instrumentation. As the editor points out, there is a "serious time lag . . . between evaluation and practice" and this series is an attempt to make possible the more rapid use of new developments. It is the intent to present "significant new developments in ideas and techniques" and also "critical evaluations and the present status of important but more classical methods and approaches." It is the desire to present "comprehensive articles surveying various topics on a high level, satisfying the specialist and the non-specialist alike."

The first volume has seven sections written by specialists in their field. Each chapter is well documented with up-to-date references, and a complete index of subject matter appears at the end of the book.

The first section discusses tetraphenylboron (TPB) as an analytical reagent. A history of the growth and development of the use of this reagent is of interest. The subsections of this chapter deal with the properties of TPB metal salts, TPB's use in gravimetric, titrimetric, polarographic, and optical methods for the determination of potassium, determination of other metal ions, diverse applications of the TPB ion, and TPB salts of organic

compounds. Numerous procedures and modifications are given in some detail, pointing out limitations and precautions.

An evaluation of some of the established methods and some recent advances in vapor detection in gas chromatography is the subject of the next section. A number of different types of detectors are discussed in relation to the principle of operation (brief), sensitivity, value, and limitations.

In the last few years the use of an increasing number of compounds of fluorine, has made the determination of this element more important. The third section presents a résumé of methods available up to 1953 and is followed in more detail by methods since that date. The author goes into sample preparation, separation of fluoride, and gravimetric, volumetric, and colorimetric determinations of this halogen. An interesting part of the section is a discussion of the difficulties past and present and the challenge for future investigation.

New ideas in organic microanalysis are the subject of the next section which considers C-H, O, N, halogens, and S and briefly discusses P, As, Sb, B, Se, Si, and Hg. A number of the 276 references to this chapter are from European journals, a fact which makes it helpful in keeping contact with world-wide developments.

The fifth section is a survey of some of the recent work in the theory of electrode processes with emphasis on those fields of interest for the electroanalytical chemist. The chapter deals mainly with the nature of electrode reactions, experimental techniques, and the effect of experimental variables such as salts, solvents, electrode materials, and other factors.

Thioacetamide is the next subject discussed. Its early history and its reactions in aqueous solutions serve as an introduction to its reactions in precipitating metal sulfides. Analytical procedures using thioacetamide for the precipitation of a number of metal sulfides are described with indications of where further study is needed.

The last section is concerned with near-infrared spectrophotometry in the spectral region between one and 3 millimicrons. A discussion of the various instruments available is followed by a discussion of their use for qualitative and quantitative organic functional group analysis. The latter deals with C-H, N-H, and O-H vibrations and also S-H, P-H, carbonyl, and nitriles and certain miscellaneous groups. A number of spectral curves are given to illustrate the text.

This volume appears to meet the objectives of the editor as indicated in the first paragraph above. The reports are well written and present an abundance of information, both theoretical and practical. This book should be available as a reference for advanced and graduate students in chemistry and pharmacy as well as the chemistry faculty of a pharmacy school.

Charles C. Clayton
Medical College of Virginia

D. R. Laurence and R. Moulton
Clinical Pharmacology
Boston: Little, Brown & Company, 1961. viii + 490 pp., figs., tbls. $10.00.

This is a first-edition textbook. According to the preface, "This book is intended primarily for medical students in their clinical years and for those newly qualified, but it is hoped that this survey of the principal drugs, with details of their use and pharmacology, may be helpful to some postgraduate students and practitioners."

The text is obviously written for the student clinician and practicing clinician and would be of little use to the pharmacist, the nurse, or laboratory personnel except as a reference text for nomenclature purposes. For this reason it is a text worthy of being included in a pharmacy school library. Quotations and personal observations and experiences in the use of drugs are prevalent in the text. The book is presented, insofar as both the quality of print and paper are concerned, in a manner that makes it easily readable.

In the twenty-nine chapters of this textbook the subjects that are dealt with include the usual classification of drugs, their action, their uses, and their toxicology. Three appendices are provided: the first deals with weights and measures; the second with dosage of antimalarial drugs; and the third with surgery in diabetic patients. Each chapter has an introductory portion with definitions and generalizations regarding the subject matter. Following this are sections dealing with the individual drugs designated by generic and proprietary name, or names. It is only natural that the authors would refer to the individual drugs by the English proprietary names. This need not be confusing since many such names are the same or quite similar to our American nomenclature.

There is a minimum of space devoted to mechanisms of action of drugs. However, there are references to some reviews and guides to further reading listed at the end of each chapter. It is unfortunate that these references are not more extensive and complete.

Paul M. Scott
The University of Kansas City

Mary Belle Allen, Editor
Comparative Biochemistry of Photoreactive Systems
New York: Academic Press, Inc., 1960. xii + 437 pp., 149 figs., 36 tbls., 1 plate. $12.00.

Volume One of this series of symposia of the Kaiser Foundation Research Institute presents a number of papers on highly specialized fields of biological chemistry and physiology. Each contribution represents a self-sufficient unit that bears the earmark of the expert. The collection comprises twenty-four papers covering a wide variety of topics ranging from the chemistry of biological pigments in animals, plants, and microbes, pigments as phylogenetic markers and as parts of photoreceptors, through physiological implications of these essential materials in photosynthesis, phototaxis, photoperiodism, and other photosensitive reactions, to problems bearing on biogenesis, biosynthesis, and participation in biochemical reactions. The comparison is made between species of different phylogeny, not between pigments of different chemical or functional types. The various aspects and pigment groups have not been integrated into unifying concepts. The role of photosensitive pigments in pathology is not included.

Photosensitive pigments are involved in numerous fundamental phenomena of living systems. The findings on these systems generally are scattered in the literature in unrelated fields but have reached such an advanced stage during recent years that the experts now have seen fit to produce excellent and timely reviews truly welcomed by the biologist who is not a specialist in these fields but who desires an understanding of them. The papers are written in a form that is understandable also to him.

The teachers and researchers in the biological areas of pharmacy will discover a gold mine of documented and integrated information in this authoritative publication.

Egil Ramstad
Purdue University

N. H. Swellengrebel and M. M. Sterman
Animal Parasites in Man
Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961. x + 652 pp., 332 figs., 5 plates. $12.00.

This book is represented as a completely rewritten version of a Dutch text which first appeared some sixty years ago and is currently in its Sixth Edition in the Netherlands. The authors claim that the book under present consideration is actually an original English work written with the intent of preserving and enhancing the various features of its earlier revisions.

The book is organized similarly to standard parasitological works into six main parts with each part being further subdivided into well-delineated chapters. Titles and number of chapters for each part are as follows: (1) Protozoa—six chapters, (2) Helminths:Trematodes—four chapters, (3) Helminths: Cestodes—five chapters, (4) Helminths: Nematodes—six chapters, (5) Arthropods—twelve chapters, (6) Technical Methods and Diagnostic Procedures—six chapters.

The book is well documented and contains a complete reference list at the conclusion of each chapter. Although many of the references date back for a considerable number of years, there is a liberal sprinkling of recent literature (as late as 1960) indicating that the authors have kept in touch with present-day developments.

It would seem that the choice of a title for the book might be somewhat misleading since it could be interpreted as meaning "parasites of animals which are transferable to man." Such is not the case, however, since the book includes a complete account of all internal and external parasites afflicting mankind irrespective of the necessity of an animal host.

For the most part the various chapters of the book are well written and contain fairly complete accounts of the life cycles and morphological characteristics of the wide range of human parasites. Emphasis is largely placed on the biology and ecology of the parasites. Sections on diagnosis are fair but in my opinion do not measure up to some of the other standard works in the field. This deficiency is balanced, however, by the various sections in each chapter on treatment. These latter sections, although not complete from a pharmacological or toxicological standpoint, include the latest drugs available and are exceptionally well organized for a book of this type. Another outstanding feature of the text is the five color plates covering the three main species of Plasmodia.

The numerous illustrations in the book are quite good. The original ones are primarily drawings of photomicrographs with a larger percentage being borrowed from other parasitological works. My main criticism on the illustrations deals with their labeling. Labeling in many cases is absent or incomplete as to the component parts, and in other cases identification of these parts is done in a language other than English.

I feel that the book could be further improved by additional sectioning of the various chapters. For example, the treatment for any given parasitic infection is given a separate

heading within the chapter, but the authors have failed to section such areas as morphology, life cycle, transmission, disease states and symptoms, public health aspects, etc. With reference to the latter two, i.e. symptoms of infection and public health, I feel that these have been largely neglected and definitely not given the emphasis which they deserve for a text to be used in a college of pharmacy.

The inclusion in the book of a separate section on clinical and laboratory technics enhances the value of the book wherever it will be used in conjunction with a laboratory course. The book does lack comparative morphological tables, which are of great importance for students undertaking the identification of parasites for the first time.

On the whole this book is well written, and the use of large type makes for easy reading. The authors have presented their case well and give impressive arguments to this end on controversial subjects. I feel that this book should definitely be included in every pharmacy library and deserves careful consideration as a possible text where courses in parasitology are offered.

Byron A. Barnes
St. Louis College of Pharmacy

Peter Gray, Editor
Encyclopedia of the Biological Sciences
New York: Reinhold Publishing Corporation, 1961. xxi + 1119 pp., 533 figs., 23 tbls. $20.00.

A broad coverage of biological topics from Theophrastus to Space Biology is presented in 800 articles arranged in alphabetical sequence. Approximately 500 specialists have contributed to this useful reference volume. The accounts are succinct but, on the whole, very adequate. Biographical sketches of many prominent biologists add to the usefulness of this collection. The figures and diagrams are good to excellent, the photographs up to usual quality. References are usually appended to the topic discussions so that the interested reader can pursue the subject further.

A one-volume encyclopedic work with a scope as wide as the biological sciences will inevitably fail to include some topics that the user expects to find. Therefore, criticism will most likely be directed to omissions. An index reveals subject matter that often could not be found without its use.

The reviewer found very few errors in the accounts he read. Even typographical slips were relatively few, e.g. Ebanales, Pyriodoxine, amygdaline, saponines, solanacous, colchium, glucocides. Some contributors obviously were more careful proofreaders than others. No topics of the "Pharm . . . ." group are included. Omission from the index of barnacle, labiates, *Neurospora,* oil, terpene, and certain inconsistencies in spelling, e.g. "estrogen" and "oestrogenic hormone" and "oestrous" may irritate some users. However, the minor shortcomings pointed out are far outweighed by the general excellence of this very commendable volume, which will be a valuable addition to the biology section of the library.

J. Hampton Hoch
Medical College of South Carolina

Deane P. Furman
Manual of Medical Entomology
Palo Alto, California: The National Press, 1961. v + 122 pp., 228 figs. $5.50.

This new manual has been created to assist students in the laboratory identification of arthropods of medical and veterinary importance. Included are exercises in the form of taxonomic keys designed as studies in diagnosis, not just systematic entomology. Techniques of preserving, mounting, and dissection of arthropods are covered.

The main feature of this manual is the collection of taxonomic keys. I found them to be very well constructed and easy to follow. This is due to the fact that they are not too wordy and cumbersome and also that they are printed in a comfortable, large print.

Special mention should be made of the very excellent illustrations by E. Paul Catts. The drawings have been well chosen and executed and will be very helpful to the beginning student. The drawings very graphically point out the similarities and differences of closely related species. On many of the figures a large black arrow points to some important taxonomic characteristics mentioned in the key. Figures 3-13 aid in the study of mouthparts. Some of the sketches show the external appearances and the cross-section sketches reveal the interrelationship of the various parts. The figures are large and not crowded on the 8 x 11 inch pages.

At the conclusion of each order unit, a list of references is given to manuals, monographs, and texts concerned with that order. This is particularly helpful for any further study.

I personally like this fine manual and feel that it should be included in the libraries of pharmacy schools. Its greatest use, however, will be as class manuals in those schools that have courses in parasitology or entomology.

Francis M. White
Philadelphia College of Pharmacy and Science

L. P. Ribeiro, E. Mitidieri and O. R. Affonso
Paper Electrophoresis
Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961. xii + 463 pp., 140 figs., 42 tbls. $14.00.

Scientists dealing with natural processes will inevitably turn to Ribeiro, Mitidieri and Affonso's book for its informative and comprehensive (3,226 references) treatment of the methods and results of paper electrophoresis. This completely revised translation of the 1958 Portuguese edition treats (1) theoretical principles, techniques and apparatus, (2) the determination and clinical applications of proteins, (3) non-macromolecular substances including hormones, vitamins, sugars, inorganic ions, and nucleic acid fragments, and (4) topics of pharmaceutical interest, such as immunochemistry, venoms and toxins, carcinogenic substances, alkaloids, antibiotics, etc. Almost all methods related to paper electrophoresis are reviewed.

Though of primary interest to the research worker, *Paper Electrophoresis* also serves in its earlier pages to orient the beginner. Brief historical accounts of the development of the field and of terminology in the first seven pages are followed by an elementary theoretical treatment confined to eighteen pages. The next twenty-three pages are devoted to methods and apparatus with the remainder dealing with results, the bulk of which treats the clinical and analytical aspects of proteins. The book is very informative with a highly factual and well-documented text interspersed with many illustrations and tables.

Much time and effort will be saved by workers in paper electrophoresis and related fields if this book is made available to them; in one volume is collected a high percentage of the information pertinent to the field. This book would be an excellent addition to libraries serving chemists, pharmacists, biochemists, medical research workers, physiologists, etc. The book appears to be thoughtfully written and carefully printed.

Douglas S. Chapin
University of Arizona

David D. Davies
Intermediary Metabolism in Plants
New York: Cambridge University Press, 1961. xii + 108 pp., 35 figs., 10 tbls. $4.00.

This is one of a series of publications called the *Cambridge Monographs in Experimental Biology*. The contents of this small volume are organized into seven chapters: (1) Metabolic Patterns and Cellular Organisation, (2) Organisation and Structure, (3) Bioenergetics, (4) Catabolism, (5) Anabolism, (6) Links between Metabolic Pathways, (7) Conclusion. Included are 216 references.

The objective of this book is not to present a review of the factual knowledge, but rather to discuss the ideas and theories of biochemical action in plants. In the reviewer's opinion, the following excerpts taken from the author's preface give an appropriate evaluation of this book:

"Progress in the study of intermediary metabolism is extremely rapid and the presentation of factual knowledge requires encyclopaedic treatment. This book represents an attempt to outline the concepts and theories of intermediary metabolism, using specific examples only to avoid becoming lost in generalisations. Topics chosen for discussion represent an arbitrary selection, the two major omissions being photosynthesis and nucleic acid metabolism. Fortunately, photosynthesis has been the recent subject of three excellent monographs (Hill and Wittingham, 1955; Bassham and Calvin, 1957; Aronoff, 1957). There has, as yet, been little work on the metabolism of nucleotides and nucleic acids in plants, but excellent reviews of work with animals and bacteria have recently appeared (Buchanan and Standish, 1959; Hartman and Buchanan, 1959).

"A few of the views expressed in this book are novel and many are controversial. It is hoped that the student will not accept any of these views unless they are in accordance with his own experience and thought. The book is based on a course of lectures given to the honours botany students of London University, but it is hoped that it will also provide students in other subjects with an introduction to the dynamic aspects of biochemistry."

E. H. Djao
The University of Texas

Pharmacy Examination Review Book, Volume I
Flushing, New York: Medical Examination Publishing Co., Inc., 1960. 179 pp. $6.00 (paper).

The *Pharmacy Examination Review Book*, as specified in a note to the reader at the very beginning, "is not a substitute for basic pharmaceutical education." The author or authors indicate that, "it has been specifically designed to assist those preparing for pharmacy state board examinations."

The table of contents of this book is divided into six sections including pharmacy, pharmacology, microbiology and public health, chemistry, biochemistry, and physio-

logy. Each section consists of various types of multiple-choice questions. At the back of the book is a key section that the reader may use to determine the accuracy of his answers. Thus it is intended that the reader test himself in the various areas included in the book and then refer to the answer section at the back of the book in order to score himself and ascertain his ability to provide correct answers to questions.

Educators have long concluded that the multiple-choice item is the most flexible and effective objective form of questioning. It is excellent for measuring information, vocabulary, understandings, application of principles, or ability to interpret data. It has been used in practically all educational areas that can be measured by a pencil and paper test except, of course, the measurement of ability to organize and to present material.

As a rule the multiple-choice item consists of two parts. The first is the "stem" which presents the problem and the second is the list of possible answers. The stem may be presented in the form of an incomplete statement or a question. Testers usually find it easier to use the question form of stem than the incomplete sentence form. The incomplete statement form is often more concise if it is skillfully used, and it requires more preparation on the part of the tester. The difficulty in answering a multiple-choice question will depend upon the "closeness" of the options. It is a well-known fact that an advantage of the objective examination rests in the reliability and validity in the grading of the examination, in contrast to the essay type test, which depends greatly on the individual who is grading the examination.

Questions presented in the *Pharmacy Examination Review Book* have not been arranged in any particular order within each section, nor have the options of the questions been selected with care. Stems that have been presented in the form of a question do not contain a question mark but end in a colon just as do those stems which have been presented in the form of an incomplete statement. The book also contains some errors, as for example a question that offers five numbers as options and a key that provides a letter for an answer.

I believe this book is interesting in some ways but fails to obtain its objective as a design to assist students preparing for state board examinations. It has not met its objective because of poor arrangement of questions, careless construction of multiple-choice questions, errors that are present, lack of uniform question structure, and limited scientific content. Students may find it useful and amusing to test one another's knowledge. The book will have little use to the educator.

Fred B. Gable
Temple University

John E. Christian and William F. Bousquet
Radioisotopes and Nuclear Techniques in the Pharmaceutical and Allied Industries
Washington, D.C.: U.S. Department of Commerce, Office of Technical Services, 1960. 119 pp., 43 figs., 6 tbls. $2.50 (paper).

Radioisotopes have been employed at an ever-increasing rate in science and industry for research and development, for production control, and for numerous other applications. This book is a report of a study on the use of radioisotopes and nuclear techniques employed by the pharmaceutical and allied industries, a study performed under contract for the Office of Isotope Development of the U.S. Atomic Energy Commission. The report is based upon replies to a questionnaire returned by 113 pharmaceutical companies. The authors state that this study has been primarily concerned with defining areas of potential radioisotope applications in production, process control, and packaging operations.

The book has been organized into three sections plus an appendix. The first, a preliminary section of sixteen pages, surveys the research and production operations of the pharmaceutical industry. Here the authors outline the objectives, methods, and scope of the study. Terms pertaining to the pharmaceutical industry and to pharmaceutical products are defined, and the scope of the pharmaceutical industry and its growth are reviewed. Finally, five pages are devoted to the structure of a pharmaceutical company, including the corporate structure as well as the structure for research and development.

In the second section, designated "Part A," and consisting of thirty-two pages, is found information on the basic nature of isotopes, savings realized by the use of isotopes, and an extensive coverage (twenty-seven pages) of the uses of isotopes. The outline of uses includes applications in research, medicine, radiation sterilization, and industrial production and control. This section also includes a list of twenty-six reference books.

The third section (Part B) is devoted to radioisotope applications in the pharmaceutical industry. The content of this section is based primarily on replies to the questionnaire, from which an analysis has been prepared on the current status of nuclear technology in the industry. This report covers, for example, the number of companies using

isotopes, specific radioisotopes used by the industry, typical research problems, and product or process evaluation problems utilizing radioisotopes as well as suggesting future applications of isotopes in the industry. A report on the status of nuclear education in colleges of pharmacy is also presented. The authors have compiled a six-page list of potential applications of isotopes which is followed by eighteen full-page diagrams illustrating specific uses.

Appendix A is a twenty-nine-page bibliography, appendix B is a brief note on activation analysis, and appendix C defines radiation units.

To the reviewer's knowledge no comparable book, written specifically on and for the pharmaceutical industry, is available. It has therefore filled a need in that area. Information of the nature presented in this report should certainly be of interest to a progressive management. It should also provide some suggestions of interest to anyone desiring to cut production costs or to improve quality control.

Grafton D. Chase
Philadelphia College of Pharmacy and Science

David Seligson, Editor-in-Chief
Standard Methods of Clinical Chemistry, Volume 3
New York: Academic Press, 1961. x + 230 pp., 10 figs., 15 tbls. $6.50.

This publication presents workable, reproducible, analytical methods, possessing dependable performance qualities, for the estimation of four enzymes, six toxicologically important compounds as well as two abnormal and nine normal blood components or their metabolites which show variability in disease. The detailed and checked procedures presented are the result of the cooperative efforts of fifty-four interested analysts.

The enzymes considered are aldolase, cholinesterase, phosphohexose isomerase and transaminase. Methods for the poisonous compounds presented include ethanol, the barbiturates, the salicylates, sulfonamides, and arsenic and mercury salts. Presentation of methods for the detection of abnormal hemoglobins, fibrinogen, catechol amines, and hydrocortisone will be particularly appreciated by laboratory personnel whose library facilities are limited or inadequate. Newcomers to the clinical field of analysis will welcome the clear-cut instructions in preparing reagents, since very often the secret to successful analyses lies in their skillful preparation. Moreover, the policy of clearly indicating sources of error inherent in the methods presented as for determinations involving ascorbic acid, chloride, creatine and creatinine, and lactic acid, as well as in the familiar area of gastric acidity testing, is a useful feature of the book.

Laboratory supervisors and instructors will be pleased with the way in which the chemical principles involved in the analyses are so clearly presented. Even veteran technologists in the field will appreciate the introductory discussions citing literature presenting earlier or alternate methods of analysis as well as the instructions for the preparation of calibration curves which make for dependable performance of the specialized instruments utilized. Moreover, they will find that the supporting references cited will be a timesaver for locating key information to broaden their own technical background as well as provide material for refresher seminars. Clinical chemists interested from a research point of view will find the discussions given on each method valuable. This since they allow all to quickly locate the literature presenting data covering variations in disease as obtained utilizing a confusing number and kind of alternate analytical methods and thus make for more accurate interpretation of their own accumulated data.

Biochemists, pathologists, hospital technology school instructors and investigators of pharmacy schools interested in active programs of study involving biochemical changes from the normal in pathological or experimentally induced conditions involving the compounds included will find in this volume a useful tool in further progress.

Myron N. Jorgensen
University of Kansas City

William M. Fishman
Chemistry of Drug Metabolism
Springfield, Illinois: Charles C Thomas, 1961. xvii + 235 pp., 99 figs., 6 tbls., 11 plates. $10.50.

This is a monograph of the Thomas *American Lecture Series* (The Bannerstone Division of American Lectures in Living Chemistry).

Dr. Fishman presents a treatise based upon well-documented studies concerned primarily with biochemical mechanisms of drug metabolism. Preceding these discussions, logically, are reviews of the basic principles of the metabolic transformations of organic chemicals and drugs. Attention to the latter is directed mainly to characteristic groups and compounds. Individual compounds are included only when they have been studied extensively and when they will serve the purpose

of example. It may be stated that no information is contained in this work concerning the pharmacologic action of the compounds discussed. The author adheres stringently and factually to the major pathways of metabolism of administered organic chemicals and drugs.

Emphasized at great length is the process of metabolic conjugation with special attention directed to the glucuronic acid conjugation. This section contains a concise, though general, discussion of glucuronic acid metabolism. This information, though not controversial, reflects Dr. Fishman's experiences in this selected field. Given special attention is a discussion of Beta-glucuronidase, its demonstrated functions, hormone and drug relationships, its enzymemorphology and current views on its biochemical significance.

Given specific consideration are discussions concerning the role of ascorbic acid in metabolic transformations and regeneration enzymes to functional forms and the author's intriguing concept of metabolic conjugation as a hydrogen-replacement reaction.

Dr. Fishman has presented the complicated subject of the chemistry of drug metabolism in a highly readable form. It is discussed in logical sequence though for the most part in general terms. Its main strength, other than being a stimulating work, lies in the fact that it contains an invaluable bibliography and clear, concise metabolic maps illustrating the written material. This reviewer does not hesitate to recommend this monograph to the teacher and researcher, accomplished and aspiring, in the field of drug metabolism.

Richard H. Gadsden
Medical College of South Carolina

E. H. Rodd, Editor
Chemistry of Carbon Compounds, Volume IV
New York: D. Van Nostrand Company, Inc., 1960. xviii + 736 pp., 63 tbls. $26.50.

The editor, E. H. Rodd, assisted by an advisory group of six, has set out to cover the chemistry of carbon compounds in a series of five volumes, each volume having two or more parts. Volume IV, in three parts, is devoted to the survey of heterocyclic compounds. The part c of Volume IV concludes the survey.

Of the fourteen chapters in this volume, the initial ones are devoted to the account of compounds with two hetero atoms in a six-membered ring which includes oxazines, thiazines, and dioxa compounds with their sulfur analogs along with dyes derived from phenazine, phenoxazine, and phenothiazine. Subsequent chapters deal with six-membered rings containing more than two hetero atoms and with rings containing more than six members. Included are chapters dealing with more complex ring systems such as purines, pteridines, and alloxazines.

Advanced work dealing with nucleosides, nucleotides, nucleotide coenzymes, and nucleic acids is surveyed in a separate chapter. The volume concludes with seven chapters which cover the many classes of alkaloids.

The contents of this volume, as has been the case with the other volumes of this series, have been classified and subclassified in a manner which permits ready reference to any selected group or class of compounds. Copious references pertaining to properties and syntheses of almost every group and class of compounds are included along with the description. Numerous tables summarizing chemical relationships of compounds belonging to a given category as well as pertinent physical and chemical data are included throughout the text.

The indexing system used for this volume is made far more practical by disregarding certain prefixes for the purpose of alphabetizing. Cross-referencing has been restricted to cases where several entries have been shared under more or less equally used alternative names.

Chemistry of carbon compounds, indeed, is too broad a subject even for five volumes. The volumes up to now in this series of five volumes have almost fulfilled the aim of presenting a fairly complete survey of carbon compounds. This work does not differ much in style or scope from many other similar literary efforts in the field of carbon compounds. However, one would recognize the limitations of volume IV, part c, of this series when compared to Hofmann's *The Chemistry of Heterocyclic Compounds.* The same will hold true for the entire series when compared to Elsevier's *Encyclopaedia of Organic Chemistry.*

In the opinion of this reviewer, the *Chemistry of Carbon Compounds* edited by E. H. Rodd would be a desirable addition to a chemistry or a pharmacy library, but it is not suitable for use as a text.

Babu N. Patel
Fordham University

F. F. Nord, Editor
Advances in Enzymology, Volume 23
New York: Interscience Publishers, Inc., 1961. v + 557 pp., 76 figs., 38 tbls. $15.50.

This volume is the latest issue of this annual review series. It contains reviews of nine topics, each of which is written in Eng-

lish. The review of the possible polypeptide configurations of proteins from the point of view of internal rotation potential (S. Mizushima and T. Shimanouchi) does not mention the quaternary structure of proteins suggested by Bernal (1958) for the more complex type of molecules formed by association of molecular units already folded. The treatment of the primary, secondary, and tertiary structures is well done. The conclusion of this review could have been made more meaningful. For example, the following statement leaves much to be desired: "The order of the amino acid residues has been determined in insulin and other hormonal proteins and in some of the enzymes."

The review of the denaturation and inactivation of enzyme proteins (K. Okunuki) clearly outlines methods that are being used to detect a denatured protein. It is to be regretted that the statement, "Endopeptidases can hydrolyze inner peptide bonds, provided that certain specificity requirements are met," is illustrated only by the giving of the requirements for trypsin activity. It would have had more practical value if the requirements of other endopeptidases had been given.

The review of periodic enzymic reactions and their possible applications (J. A. Christiansen) is written for specialists with a major in mathematics. The mathematical treatment of meager experimental evidence leaves one with the impression that a great deal of this work is of questionable value.

The review of pancreatic lipase (P. Desnuelle) is very enlightening and points out that the definition of an enzyme should not be based on the over-all reaction which it catalyzes without consideration of the physical state of the substrate.

The review of collagenases and elastases (I. Mandl) is of particular value to those interested in preparing collagenolytic enzymic débridement preparations in the treatment of burns, osteomyelitis, decubitus ulcers, etc. The author gives an excellent survey of the present state of our knowledge of collagenase and elastase.

The review of cytochromes of Group A and their prosthetic groups (R. Lemberg) describes recent advances in our knowledge of the structure of the prosthetic groups of the cytochromes included at present in the type *a* cytochromes. The little that is known about the relationship of structure and function is given and will be appreciated by the reader even though this was not one of the major objects of this review.

The review of the synthesis of adenosine triphosphate (E. Racker) is treated exhaustively and throws considerable light on the mechanism of oxidative phosphorylation.

The review of the metabolism of 2-carbon compounds by microörganisms (H. L. Kornberg and S. R. Elsden) gives particular attention to acetate, glycolate, oxalate, and glycine in which a pattern of metabolic behavior is seen in some sort of perspective.

The final chapter on the discovery and the chemistry of mevalonic acid (A. F. Wagner and K. Folkers) is brief and to the point.

This volume is necessary for every graduate student interested in research in the field of enzymology. The major objectives of each reviewer have been accomplished. The printing is excellent.

Charles W. Bauer
Massachusetts College of Pharmacy

Erwin Chargaff and J. N. Davidson, Editors
The Nucleic Acids, Volume III
New York: Academic Press, 1960. xvi + 588 pp., 85 figs., 41 tbls. $18.00.

The Nucleic Acids, Volumes I and II, appeared in 1955, and during the five years since this valuable treatise was published knowledge relating to the chemistry and biological functions of nucleic acids has continued its phenomenal growth. Volume III is a "diagonal supplement" (in the words of the editors) to these volumes, i.e., a selection of articles relating to and updating the systematic arrangement in the preceding volumes. Six papers are concerned with the chemistry and physical properties of deoxyribonucleic acid and ribonucleic acid including macromolecular weight, shape and dimensions, photochemistry, chemical and enzymatic synthesis of polynucleotides, and the characterization of the nucleic acids of microorganisms and bacterial, plant, and animal viruses. Six papers are devoted to nucleic acid metabolism including biosynthesis of purine and pyrimidine nucleotides, the related biosynthesis of nucleic acid and protein in cell-free systems (derived primarily from animal sources) and in whole bacterial cells, the inhibitors (structural analogs) of nucleic acid metabolism and the effects of radiation on nucleic acid metabolism. Topics which have achieved particular importance since the publication of the earlier volumes are emphasized, and the authors, all international authorities who were not involved in the earlier publications, have succeeded in a work which enhances rather than downgrades the original volumes.

Each paper has an extensive bibliography, and the literature is well documented to 1960. Experimental data and conclusions of diverse

references are analyzed and discussed by the authors, and each paper has most valuable original data from the author's laboratory. Much of this information was not previously published and is tremendously helpful to research people and teachers in this field since it refines and clarifies swiftly moving aspects of the subject.

This book and the prior volumes are well qualified to serve as the primary reference for a broad spectrum of biological scientists. Nucleic acids stand at the forefront of the rapidly advancing knowledge in biochemistry, and students, teachers, and investigators in biological science will be richly rewarded in availing themselves of the information in this publication. *The Nucleic Acids* should be in every library and will have wide application in graduate teaching and research.

Edward J. Herbst
University of Maryland

Andres Goth
Medical Pharmacology
St. Louis: The C.V. Mosby Company, 1961. 551 pp., 52 figs., 18 tbls. $11.00.

This is an excellent attempt by Dr. Goth, professor and chairman of the department of pharmacology, University of Texas Southwestern Medical School, to collate the major material of present-day pharmacology into a textbook suitable for medical students. The author accomplishes his purpose well. This textbook is equally suitable for a beginning course in pharmacology for pharmacy students. Dr. Goth has attempted to eliminate clinical medicine and therapeutics and to provide for the student of pharmacology a succinct, readable presentation of essential pharmacodynamics by using a "class" compound where possible and eliminating the repetitious description of the pharmacology of closely related drugs. The book is probably as brief a textbook in pharmacology as can be written without being telegraphic. The reviewer highly recommends this book in a field where the existing well-written texts are much too encyclopaedic to be of any real value to a beginning student.

The illustrations and tables are clear and well chosen and well depict the concepts that were meant to be emphasized. The chapters on "Tranquilizing Drugs" and "Psychomotor Stimulants and Psychomimetic Drugs," those on the hormones, and the several chapters on antibiotics deserve special commendation. The presentations of "Adrenergic Drugs," "General Aspects of Neuropharmacology," and "Amine Metabolism and the Central Nervous System" add much to the book.

Although the text is subtitled Principles and Concepts, the chapter on "General Aspects of Pharmacology" is not well developed. Narcotic and analgesic drugs are given only a cursory coverage, and vitamins are poorly presented. A minor criticism of this book might be the apparent haphazard selection of references, many of which are not suitable for the student and would be of value only to a researcher actively engaged in the particular field. Nor does the reviewer see justification for some sixty-five references following the chapters on histamine and antihistaminics. The author might well have limited the references to reviews and monographs.

Generally, the book is well written; it has some errors of omission but few of commission. It should have wide use as a textbook for medical and pharmacy students. Dr. Goth should be complimented for presenting a useable and readable text.

Theodore M. Brody
University of Michigan

L. L. Langley
Cell Function
New York: Reinhold Publishing Company, 1961. xii + 377 pp., 118 figs., 18 tbls., 2 plates. $7.50.

This book consists of nineteen chapters and is divided into four parts. Parts I and II include Chapters One through Nine and deal specifically with the cell. In discussing cell components the author has very nicely pointed out facts that are known for certain and things that in the light of present knowledge still are unclear, unsolved, or represented theoretically.

Metabolism is covered in two chapters. One chapter deals with the basic principles of metabolism, and it is here that enzymes, energy metabolism, and intracellular oxidation are discussed. It is pointed out to the reader how cells are able to provide energy for their own need as well as the total organism. Another chapter covers the basic reactions of metabolism, and the author ingeniously presents the specific reactions of energy transformation in three phases. Phase I covers hydrolysis of carbohydrates, fats, and proteins. Phase II gives a clear coverage of anaerobic glycolysis, fatty acid oxidation, and deamination. Phase III includes the citric acid cycle and a scheme illustrating the interconversions of proteins, glucose, and fats and shows that the tricarboxylic cycle is the final common metabolic pathway. The author also presents an easy-to-understand discussion with illustrations of respiratory

enzymes. This same chapter includes an outstanding coverage of biosynthesis of carbohydrates, lipids, and proteins by the cell.

Chapter Eight deals with reproduction, growth, and aging. Aging theories are given under two headings, toxicity theory and protein changes; and the author presents evidence in support of both theories. In this same chapter cancer is defined by the author's describing cancer cells, morphology and mitosis of the cancer cell, and briefly discussing the etiology of cancer.

Chapter Nine presents a very concise, yet adequate, orientation of radioisotopes and radiation. Absorption and biological effects are discussed, and, in the light of our present mode of warfare, this chapter will no doubt be of great interest to the reader.

Part III deals with the integration of the cell in the total organism, which encompasses Chapters Ten through Fifteen, where body tissues and the various body systems are considered.

Part IV features Chapters Sixteen through Nineteen under the heading of Basic Background Principles. This section very definitely enhances the value of the book, as it affords a review in aspects of basic chemistry and physics relative to physiology. Of greater value to the student of this section are the chapters dealing with methodology and data. The chapter on methodology is designed to bring a student up to date on the various laboratory and research techniques. The chapter on data points out to the student how to analyze raw data statistically. The popular statistical treatments of data are given along with statistical formulas and tables that are quite valuable to all workers in biological sciences.

Cell Function affords other advantages to the student by having at the end of each chapter a summary, problems and questions designed to cause the student to recapitulate the material, and also additional reading references that may guide the student to literature of specific topics. The index is very complete with the illustrations listed in boldface type.

In a school of pharmacy the course in physiology should emphasize human physiology. However, *Cell Function* should be in all pharmacy libraries, as it will be of value to the student of pharmacy in helping him to understand the various intracellular processes and to see the influence or effects of various drugs, hormones, and enzymes which influence intracellular response, thus influencing the whole organism.

Samuel K. Laffoday
Mercer University

H. R. Shepherd, Editor
Aerosols: Science and Technology
New York: Interscience Publishers, Inc., 1961. xiv + 548 pp., 149 figs., 52 tbls. $22.50.

The phenomenal growth of the aerosol industry over a period of the past fifteen years was based, to a large extent, on the interchange of scientific and technological information among a variety of industries. Since the aerosol package involves a balanced composite of container, propellents, valve, and contents, it is essential that anyone doing developmental work in this area become thoroughly familiar with the pertinent details of all the variables introduced by these essential components of the pressure package. This book is a survey of this new technology and presents a comprehensive treatment of theory and practice, laboratory and manufacturing techniques, and formulas. The appendix offers a summary of aerosol shipping regulations of the Interstate Commerce Commission.

This is the second book of its kind to be published, and the scope of its contents is generally superior since it utilizes the multi-author approach in presenting its information. Each of the sixteen chapters has been written by a recognized expert in his field. The chapters on theory and practice, containers, valves, propellents, laboratory techniques, and formulation design are especially well written and are organized in a manner designed to present a thorough coverage of the topics but still offer comprehensibility to the novice in the field.

Chapters dealing with special types of aerosols such as perfumes, cosmetics, pharmaceuticals, foods, pesticides, and coating compositions are necessarily rather incomplete in their coverage. They nevertheless offer valuable information and formulas which an interested beginner may use as an adequate springboard in developing proficiency.

Each chapter contains a list of pertinent references and many important figures and tables which are quite valuable in illustrating the text. Only three typographical errors were observed by this reviewer. On the whole, the book is well organized and written so as to avoid the unnecessary duplication of material which is so common to multi-authored technical books. It is recommended as a valuable textbook or reference for libraries, for laboratories, or for anyone working with the pressure package.

Joseph L. Kanig
Columbia University

Clark, Ralph W.
Orientation in Pharmacy. Second Edition
Philadelphia: Lea & Febiger, 1961. iv + 178 pp. $4.50.

The author states that this Second Edition has the same purpose as the original work: namely, to present an overview of pharmacy to beginning students. The new format is certainly an improvement since it gives the appearance of a textbook with lasting value. Most of the material has been revised, corrected, and expanded; and a new chapter on the pharmacy college library has been added.

One attractive feature of the new edition of this book is the list of additional reading references which follows most of the chapters as well as a general list following the introduction. These should be beneficial to both students and instructors.

The author has included those topics which should be of most value to beginning students; therefore, this text offers an excellent outline for an introductory course in pharmacy. The chapter on opportunities in pharmacy and the required preparation for these careers should be of special interest to students in the five-year program who may have very little contact with the college of pharmacy during their first and/or second years of the curriculum.

The brief discussion of the historical development of pharmacy, in general, and of American pharmacy, in particular, provides the instructor with an opportunity to develop these topics as time and conditions dictate without overwhelming the students with a mass of details.

The topic of ethics is presented in a manner that should help to develop an appreciation of the moral and social obligations of a pharmacist. Public relations, new drug development, and the status of pharmacy are discussed in separate chapters. A chapter is devoted to pharmaceutical economics, which some instructors may wish to omit. It is regrettable that the author included some material in this chapter that will be outdated very quickly and some other points on prescription pricing with which beginning students are not prepared to cope.

Orientation in Pharmacy compares favorably with other textbooks in this area. It is not a treatise on pharmacy and, therefore, offers the instructor ample opportunity to introduce such supplementary material as time and conditions permit.

This book should not only be considered as a textbook for new students, but also as a valuable source of information for high school guidance directors, pre-pharmacy advisors, and pharmacists who are interested in recruitment.

Louis D. King
Rutgers—The State University

Ashton L. Welsh
The Fixed Eruption
Springfield, Illinois: Charles C Thomas, 1961. xv + 248 pp. $9.75.

Those familiar with some of the earlier publications of Dr. Welsh, a dermatologist with a special interest in the field of drug allergy, will expect a well-documented, thoroughly scholarly account of the phenomenon which is the subject of this monograph.

In this, they will not be disappointed. The book is filled with facts presented largely in the form of case histories or culled from the 440 publications cited in the author's bibliography.

Peculiarly, however, all this loving scholarship has been lavished upon a single type of drug reaction—one which, as the author himself states, is "certainly NOT (emphasis his) common." The effect of such specialization is somewhat comparable to the spectacle of a battleship bringing its biggest guns to bear on a rowboat in order to blow it out of the water.

One does not wish, however, to appear condescending toward this work. All knowledge is useful, and there must be specialists somewhere who will share Dr. Welsh's enthusiasm for his subject. Certainly, the Teutonic-titanic effort to bring together almost all the available information about this topic between the covers of one book is, in its way, admirable. What makes the work seem somewhat ludicrous at times is the paucity of useful generalizations that can be drawn from the vast body of detail presented.

What is a "fixed eruption"? Essentially, it is a type of allergic reaction characterized by lesions of various kinds that recur repeatedly at precisely the sites previously affected, when a hypersensitive individual is re-exposed to a particular drug or chemical. These eruptions develop mainly on skin surfaces and adjacent mucous membranes, but the term "fixed" has also been extended to include allergic symptoms that keep recurring in other extracutaneous body tissues and systems.

Ten chapters are devoted to documenting fixed reactions reported for certain major drug groups and a wide variety of individual agents. The eleventh and final chapter offers a brief recapitulation and attempts to formulate some conclusions. This discussion does

little, however, to clarify and make meaningful the confused impression that emerges—for the non-specialist at least—from the welter of diffuse detail presented in the countless clinical case histories. Or, as the author himself states, "Obscurity clouds present understanding of fixed eruptions . . ."

None the less, this monograph seems to accomplish what it set out to do for those best qualified to profit from it—to renew interest in the fixed eruption and to promote study of it by dermatologists.

Unfortunately, this book, with its broad coverage of so narrow an area, appears to have little practical utility for most students and practitioners of pharmacy. It may be recommended to pharmacy school libraries with funds enough to permit purchase of any and all volumes dealing with drug actions. But others will prefer to wait for a less elaborate treatment of this minor topic, preferably one which appears as part of a more definitive volume dealing with the whole subject of drug allergy.

Morton J. Rodman
Rutgers—The State University

New Books

Nicolas Rashevsky
Mathematical Principles in Biology and their Applications. Springfield, Illinois: Charles C Thomas, 1961. xvi + 128 pp., 35 figs. $6.00.

John A. Kolmer
Clinical Diagnosis by Laboratory Examinations. Third Edition. New York: Appleton-Century-Crofts, Inc., 1961. xix + 576 pp., 158 illus., 18 tbls. $10.00.

Lawrence F. Costello and George N. Gordon
Teach with Television. New York: Hastings House, Publishers, 1961. 191 pp., illus. $5.50.

Foster D. Snell and C. T. Snell
Colorimetric Methods of Analysis. Third Edition. Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961. x + 576 pp., 26 figs., 22 tbls. $12.75.

Philip Lewis
Educational Television Guidebook. New York: McGraw-Hill Book Company, Inc., 1961. xii + 238 pp., 98 figs. $4.95.

Edward Staunton West and Wilbert R. Todd
Textbook of Biochemistry. Third Edition. New York: The Macmillan Company, 1961. xiv + 1423 pp., 160 figs., 156 tbls., illus. $16.75.

William F. Russell, Jr. and Gardner Middlebrook
Chemotherapy of Tuberculosis. Springfield, Illinois: Charles C Thomas, 1961. xiv + 130 pp., 6 figs., 41 tbls. $6.50.

Cyril Long, Editor
Biochemists' Handbook. Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961. xxii + 1192 pp., 54 figs., 537 tbls., illus. $25.00.

N. N. Klemparskaya, O. G. Alekseyeva, et al., Editors
Problems of Infection, Immunity and Allergy in Acute Radiation Diseases. Translated from Russian by Lydia Venters. New York: Pergamon Press Ltd., 1961. viii + 165 pp., 34 figs., 29 tbls. $7.50.

C. Ladd Prosser and Frank A. Brown, Jr.
Comparative Animal Physiology. Second Edition. Philadelphia: W. B. Saunders Company, 1961. ix + 688 pp., 278 figs., 55 tbls., illus. $15.50.

J. A. V. Butler, B. Katz, and R. E. Zirkle, Editors
Progress in Biophysics and Biophysical Chemistry, Volume II. New York: Pergamon Press Ltd., 1961. v + 277 pp., 80 figs., 10 tbls., 3 plates. $12.50.

Mary Foley Horkheimer and John W. Diffor, Editors
Educators Guide to Free Filmstrips. Thirteenth Edition. Randolph, Wisconsin: Educators Progress Service, 1961-1962. viii + 165 pp. $6.00.

E. Rothlin, Editor
Neuropsychopharmacology, Volume 2. Princeton, New Jersey: D. Van Nostrand Company, Inc., 1961. xii + 521 pp., 187 figs., 88 tbls. $24.00.

C. P. Stewart and A. Stolman, Editors
Toxicology, Mechanisms and Analytical Methods, Volume II. New York: Academic Press, Inc., 1961. xvi + 921 pp., 51 figs., 106 tbls., 7 plates. $25.00.

The Extra Pharmacopoeia Supplement 1961. Philadelphia: Rittenhouse Books, 1961. xi + 315 pp., 5 tbls. $6.50.

Alice Lorraine Smith
Carter's Principles of Microbiology. Fourth Edition. St. Louis: The C. V. Mosby Co., 1961. 603 pp., 193 figs., 9 tbls. $6.00.

G. Mattock
pH Measurement and Titration. New York: The Macmillan Company, 1961. xiv + 406 pp., 83 figs., 37 tbls., 15 plates. $14.50.

Jean Bracket and Alfred E. Mirsky, Editors
The Cell, Volume II. New York: Academic Press Inc., 1961. xiv + 916 pp., 323 figs., 14 tbls. $25.00.

Patricia H. Suttles and John Guy Fowlkes, Editors
Elementary Teachers Guide to Free Curriculum Materials. Randolph, Wisconsin: Educators Progress Service, 1961. xiv + 346 pp. $7.50.

R. G. Macfarlane and A. H. T. Robb-Smith, Editors
Functions of the Blood. New York: Academic Press Inc., 1961. liv + 635 pp., 128 figs., 9 tbls. $16.80.

Jack Smolensky and Franklin B. Haar
Principles of Community Health. Philadelphia: W. B. Saunders Company, 1961. vii + 352 pp., 73 figs., 15 tbls. $6.00.

Gerald Carson
One for a Man, Two for a Horse. New York: Doubleday & Company, Inc., 1961. 128 pp., illus. $7.50.

C. P. Stewart, S. C. Frazer and P. C. Jocelyn, Editors
Proceedings of the Fourth International Congress on Clinical Chemistry. Baltimore: The Williams & Wilkins Company, 1961. xvi + 212 pp., 82 figs., 18 tbls. $8.00.

Taito O. Soine and Charles O. Wilson
Rogers' Inorganic Pharmaceutical Chemistry. Seventh Edition. Philadelphia: Lea & Febiger, 1961. 704 pp., 7 figs., 12 tbls. $10.00.

John C. Krantz, Jr. and C. Jelleff Carr
Pharmacological Principles of Medical Practice. Fifth Edition. Baltimore: The Williams & Wilkins Company, 1961. xi +1498 pp., 66 figs., 54 tbls., 4 plates. $15.00.

Alexander R. Surrey
Name Reactions in Organic Chemistry. Second Edition. New York: Academic Press Inc., 1961. x + 278 pp. $18.00.

Edward P. Claus
Pharmacognosy. Fourth Edition. Philadelphia : Lea & Febiger, 1961. 565 pp., 227 figs., 1 plate. $12.50.

Fritz Gstirner
Grundstoffe und Verfahren der Arzneibereitung. Stuttgart, Germany: Ferdinand Enke, 1960. xi + 1006 pp., 116 figs., 154 tbls. DM 138 (about $34.50).

MISCELLANEOUS

Earl J. McGrath
Memo to a College Faculty Member. New York: Institute of Higher Education, Teachers College, Columbia University, 1961. ix + 54 pp., 7 tbls. $1.75 (paper).

Investing in Scientific Progress. Washington, D.C.: National Science Foundation, 1961. 30 pp. Free (paper).

Digest of One Hundred Selected Health and Insurance Plans under Collective Bargaining, Early 1958. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1958. 253 pp. $1.25 (paper) (Cat. No. L 2.3:1236).

The Federal Basis for Weights and Measures. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1958. 23 pp., illus. $0.30 (paper) (Cat. No. C 13.4:593).

Scientific Progress, The Universities and the Federal Government. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1960. 32 pp. $0.15 (paper) (Cat. No. Pr 34.8:Sci. 2/4).

Basic Nursing Education Programmes. Geneva: World Health Organization Public Health Papers No. 7, 1961. 81 pp. $1.00 (paper).

Film Reference Guide for Medicine and Allied Sciences. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1961. 200 pp. $1.00 (paper) (Cat. No. FS 2.211:961).

Scientific Manpower, 1960. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1961. 52 pp., illus. $0.40 (paper) (Cat. No. NS 1.14:960).

Educational and Cultural Exchange Opportunities. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1961. 27 pp. $0.15 (paper) (Cat. No. S 1.67:77).

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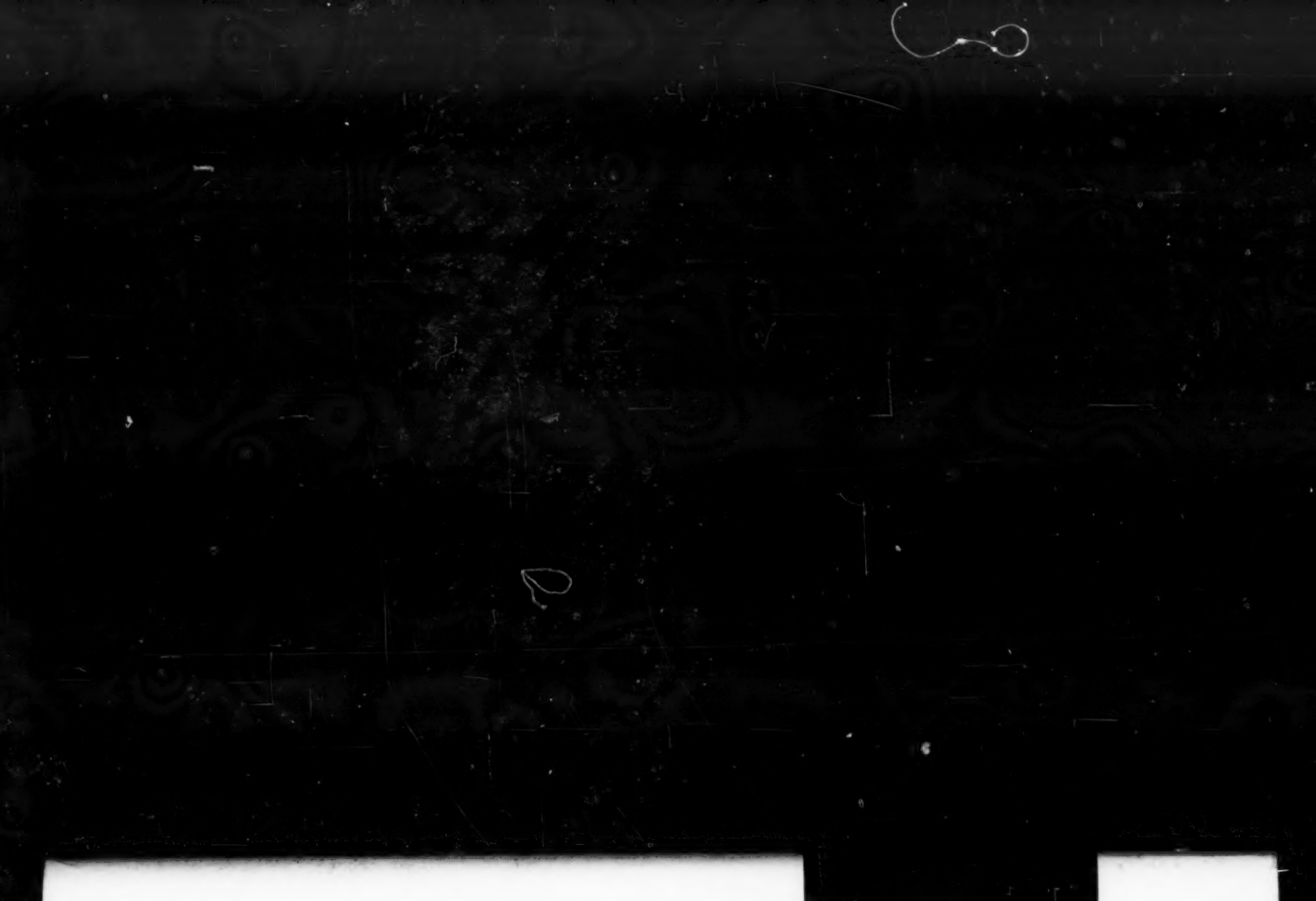
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